Cement MILL EDITION of

Concrete

Devoted to the Manufacture, and Use, of Portland Cement

FEBRUARY, 1934

400 West Madison Street
Chicago, Illinois

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JOIN THOSE A. C. I. DELEGATIONS

FOR members of the concrete construction industry, Toronto is the hub of the North American Continent from February 19 to 22.

¶ It is there that the American Concrete Institute and its younger brother, the Concrete Masonry Association, will gather for their annual meetings.

¶ Whether the state of one's personal or company finances permits him to ride in a Pullman, a day coach, or a caboose, the one important thing is to be there, to give personal support to these conventions through his actual presence.

¶ This year of 1934 has all the earmarks of being the first year of definite recovery for the construction industry—a recovery actually started in the late months of last year, and shown by first reports to be continuing at a rapid pace during the month just closed.

¶ Construction recovery is predicted in the Dodge reports, in the Brookmire reports, and in others, and it is plainly indicated by what has happened in the last few months.

¶ Recovery of the construction industry as a whole means recovery of concrete construction, for practically all construction work requires concrete in varying quantities.

¶ An inspiring week is in store for the men who'll set aside their worries long enough to join the delegations headed for Toronto. This double-headed convention should be a historical gathering, marking the beginning of a new era in concrete construction.

INSTANTLY...

A "FINGER PRINT" OF SILVER IDENTIFIES QUALITY!

FINGER PRINTS—positive identification of individual persons—find a perfect simile in the silver colored strand that runs throughout the length of American Steel & Wire Company Monitor Silver Strand Wire Rope. In this case, however, quality is the factor identified—positive assurance of superior performance and utmost economy. In Monitor Silver Strand Wire Rope—the strongest grade of steel used in wire rope construction assures strength to spare. Also, of great value, are its lightness and abrasion resisting qualities.

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VOL. XLII, No. 2 Concrete FEBRUARY, 1934

Concrete Industry Prepared for 1934

New Types of Cement Coming Forward—Heavy-Duty Concrete Pump New Factor in Job Distribution—Vibration Gains General Acceptance — Rigid-Frame Concrete Bridges Most Economical Type — Earthquake Popularizes Monolithic Concrete

THE construction volume in 1933 dropped to the lowest point of many years, reaching a total of $1,255,708,400 in contracts awarded in the 37 states east of the Rocky Mountains—according to the F. W. Dodge reports — compared with $1,351,158,700 in 1932.

A mere comparison of totals for the two years, however, does not tell the story. For the true story, reference should be made to Figure 1, in which the heavy line represents the volume of construction contracts in 1933 and the lighter line represents 1932, both compared on a percentage basis with the period from 1923 to 1925, inclusive. This diagram reflects the spectacular pick-up in the last quarter of 1933, stimulated mainly—but not entirely—by the PWA construction program.

Strangely enough, contracts for factory buildings awarded in 1933 were almost three times as large as the total recorded for 1932.

Earthquake Tests Construction Types

An earthquake shock of major intensity, measuring from VIII to X on the Rossi-Forel scale, shook a number of southern California cities on March 10, giving rise to much discussion of proper construction types and methods for earthquake zones. As a result of the various investigations and reports following the disaster, monolithic concrete construction has become generally accepted and recognized as the type best qualified to resist seismic disturbances. Random concrete ashlar masonry, though employed in only a few buildings, performed equally well.

Articles and reports covering this earthquake will be found in the April (1933) issue of CONCRETE, pages 9 and 11; in the May issue, page 5; in the June issue, page 10; and in November, page 5.

New Types of Cement

The cement-using members of the construction industry are becoming more widely informed on the significance of the fineness and the chemical composition of cement. The year just closed contributed much to this fund of information. Gradually the users of cement are being won over to the belief that certain properties of cement, such as fineness and chemical composition, must be better understood by the user himself than in the past.

Foremost among the contributions to this subject was the A. S. T. M. paper by P. H. Bates, abstracted on pages 3 and 4 of the August (1933) issue of CONCRETE. Mr. Bates stressed the point that there is no "all-purpose" cement; and, in effect, he recommended the introduction and general use of at least six types of cement, namely, high-early-strength cements, plastic cements, those having low heat of hardening, others having low volume change, cements offering resistance to moisture and aggressive solutions, and at least two having the nature of present standard portland cement, one of the two being lower in lime and higher in silica than the other. This proposal was discussed editorially on page 11 of the August issue.

Other contributors to our knowledge of the chemical properties of cement include an A. C. I. paper by Raymond E. Davis, R. W. Carlson, G. E. Troxell and J. W. Kelly, abstracted on page 14 of the August (1933) issue of CONCRETE. This paper discusses the types of cement developed for use in Boulder Dam. In addition, an A. S. T. M. paper by Carlson and Troxell, covering blends of silica and portland cement, will be found in condensed form on pages 5 and 6 of the October (1933) issue of CONCRETE.

As a matter of fact, a large cement manufacturing company in Mexico has introduced several new cements designed to meet the demand for special cements for special conditions of service.

Fineness of Cement

Contributions to knowledge of the meaning of fineness of cement will be found in articles by E. W. Reed-Lewis, on pages 14-16 of the February issue of CONCRETE, and on pages 11 and 12 of the March issue; by W. E. Corbett, in the June issue, pages 8 and 9; and by S. Rordam, in the October issue, pages 9 and 10.

Transporting Cement; Ready-Mixed Concrete

The transporting of bulk cement by special railway cars received much attention in 1932, and further advances in this direction were made in 1933. A notable contract for which about 70,000 bbl. of cement were shipped in bulk direct from the cement mill to the construction site was that of Dam No. 4, south of St. Paul, Minn., described on pages 3 and 4 of the December (1933) issue of CONCRETE.

Facilities required for the unloading of bulk cement from railway cars were discussed in a reply to an inquiry, on page 22 of the January (1933) issue.

During 1933 the A. S. T. M. adopted tentative purchase specifications covering ready-mixed concrete, thereby aiding architects and engineers in specifying the use of concrete delivered in this form. Several interesting articles on the use of ready-mixed concrete appeared in the March issue of CONCRETE, pages 3 and 17, while in the April issue, page 18, will be found a list of literature on this subject.

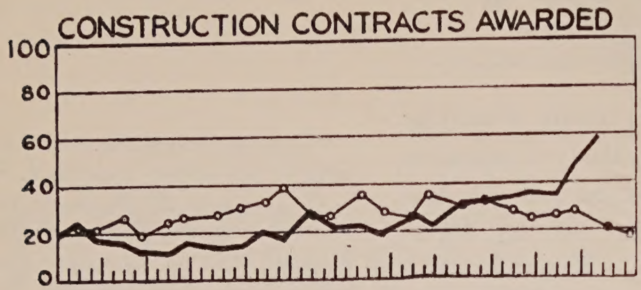


Figure 1. Construction contracts in rapid pick-up in last quarter of 1933, shown in heavy line. Light line is for 1932. Both lines show comparison on percentage basis with period from 1923 to 1925, inclusive

Pumping Concrete

A most spectacular development in the distribution of concrete from the mixer to the forms is seen in the new concrete pumping equipment, described in the September (1933) issue of CONCRETE, pages 3 and 4, and on page 4 of the December issue. This equipment pumps concrete in a continuous flow, delivering from 25 to 50 cu. yd. an hour and handling coarse aggregate as large as 2½ or 3 in.

High-Frequency Vibration

Considerable progress was made in 1933 toward general acceptance of high-frequency vibration as a positive aid in placing concrete. With the use of vibrators, the water-cement ratio may be reduced (other proportions being unchanged), or the proportion of coarse aggregate may be increased, and concrete of greater density may be obtained. Articles dealing with various phases of vibration appear on page 13 of the May (1933) issues of CONCRETE, on page 13 of the July issue, on pages 8 and 12 of the August issue, and in the issue of January (1934), page 15.

In general, it can be said that the trend in vibration leans toward the use of internal vibrators where possible, in preference to devices attached to the formwork.

Architectural Concrete

Architectural concrete constituted an important part of the 1933 convention program of the American Concrete Institute, and this subject will play an equally important role in the forthcoming convention at Toronto. The Portland Cement Association, likewise, is continuing its attention to this use of monolithic concrete, disseminating information to architects on methods of placing and on results being obtained.

Cold Weather Concreting

It can not be said that any new developments have occurred in the field of concreting in cold weather, inasmuch as the principles to be followed are well known.

There is in evidence a growing realization, however, that the increased cost of carrying on concrete work in cold weather is far less than commonly supposed. The actual cost of providing protection is, in fact, offset in considerable part by less tangible advantages such as earlier completion. There exists, also, the further realization that construction work must be pushed forward, regardless of weather, as a means of providing employment.

Rigid-Frame Concrete Bridges

Notable progress was made in 1933 in the advancement of the rigid-frame type of reinforced concrete bridge, as evidenced by the railway structure described in CONCRETE, January, 1934, pages 5 and 6. The striking economy of this type is well known to experienced designers.

Those designers who are not familiar with the analysis of this type of structure will find reviews of books covering the subject in the October (1933) issue of CONCRETE, page 18, and in the issue of September, 1931, page 38.

Construction Prospects for 1934

Prospects for substantial improvement in construction volume—and that means concrete construction—are at last based on a solid foundation. Referring again to Figure 1, the sharp rise in volume of contracts awarded shown in the last quarter of 1933 is a most encouraging index of what may be expected in 1934.

The prospects for 1934 become even more encouraging when one remembers that most of the contracts awarded in the later months of 1933 are just now arriving at the stage of actual construction. Every contract awarded will be subject to a similar period of delay. But as the awarding of contracts continues without cessation, so will actual construction work grow in scope and volume as the spring months approach.

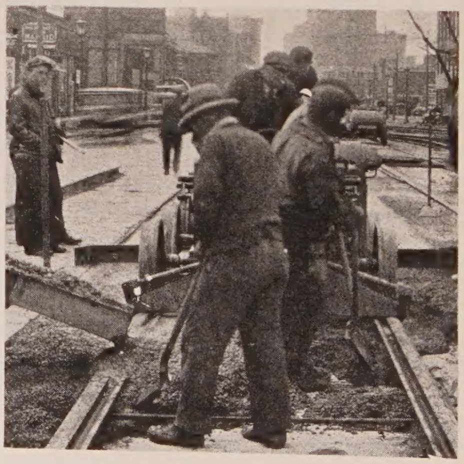


Figure 2. High-frequency vibration gains acceptance in all phases of concreting. Street railway track work in Kansas City

With a huge volume of public works construction definitely assured, the activities aroused in all directions as a result of that construction is certain to stimulate privately financed work in constantly growing volume.

Concrete Masonry Industry Sees 1934 as Beginning of New Era

More Active Construction to Provide Outlet for New Developments—To Play Definite Part in PWA Program—Some New Types of Construction

WHILE the concrete masonry industry was given but a small portion of cheering news in 1933, the year was not without its accomplishments. In looking back over 1933, one is inclined to regard it as a year of preparation—a year of preparation for the next period of active construction, which may even now be seen in its early stages.

The Concrete Masonry Code

Among the various activities that were crowded within that year of preparation, the development and adoption of the Code of Fair Competition for the Concrete Masonry Industry stands, of course, as the most prominent. Filed on August 12, the code was subjected to a final examination and hearings on November 1, 2 and 3, and signed by the President on November 27. Its essential provisions were discussed in an article in the December (1933) issue of CONCRETE, page 13.

Appointment of the governing committee, or Code Authority, has since been announced, with the statement that headquarters will soon be established at New York. The chairman of the Code Authority is Benjamin Wilk, general manager of the Standard Building Products Company, Detroit, Michigan, and the secretary is H. W. Bush, 211 Edgemont Place, Teaneck, New Jersey.

What Part in Construction Program

During the slow and painful development of the PWA administrative organization, leaders of the concrete masonry industry gave much thought to the part that concrete masonry units and other precast concrete products might play in the great public works construction program. It was realized, after so much time had been lost in getting the administrative machinery into operation, that actual construction activity in large volume could not be expected until 1934, even though the volume of contracts awarded started on an upward climb about the first of September.

An analysis of the types of construction projects that will utilize concrete products, and the kinds of products required, will be found in the December (1933) issue of CONCRETE, page 14. The July issue, pages 3 and 4, contains an analysis of the entire PWA construction program.

Standard Specifications

It was in 1932 that the concrete masonry industry made its memorable advance toward gaining its rightful place in the picture of nationally accepted standard specifications. In 1933 some changes and some further gains were made.

The principal change in standards was accomplished in the revision of standard dimensions for concrete building units, as set forth in the U. S. Bureau of Standards Simplified Practice Recommendation R32-32 and published on page 12 of the June (1933) issue of CONCRETE. Dimension tolerances have also been changed.

The A. S. T. M. specifications for concrete brick were revised and reissued in 1933 under the serial designation of C55-33T. Former strength requirements have been increased. The revised specification was printed in full on page 6 of the August (1933) issue of CONCRETE.

The Federal Specifications Board also adopted a standard specification for concrete brick, effective February 15, 1933, and issued under the serial designation of SS-B-663 (see page 12 of the February, 1933, issue of CONCRETE).

As a matter of interest to products manufacturers, reference is made, on page 12 of the August (1933) issue of CONCRETE, to specifications for light precast concrete floor and roofing slabs issued by the British Standards Institution, 28 Victoria St., London, S.W.1, England.

Tests and Investigations

The manner in which large-scale tests and investigations of concrete masonry units have broken down the former prejudice against this product were set forth in a paper read before the 1933 annual meeting of the Concrete Masonry Association by Benjamin Wilk. The author's abstract of this valuable paper appears on pages 3 and 4 of the April (1933) issue of CONCRETE.

The March (1933) issue, page 22, contains a review of Bulletin No. 251 of the engineering experiment station, University of Illinois, on "Strength and Stability of Concrete Masonry." This Bulletin includes the report of tests on full-size concrete masonry walls conducted at the University of Illinois in 1931—tests which have been instrumental in gaining recognition for this type of construction.

Much Interest in Precast Joists

Getting into the market for concrete products, precast reinforced concrete joists have caught the attention of the industry. Here is a product, as explained by E. W. Dienhart in the March (1933) issue of CONCRETE, pages 15 and 16, that fits in logically with the idea of concrete floor construction in dwelling houses, for the method of assembly approaches closely to that of wood joisted floor construction. In a word, a floor consisting of precast reinforced concrete joists supporting a light concrete slab is not a radical departure in construction for the average house builder.

The Portland Cement Association is giving much attention to the dissemination of information on precast reinforced concrete joists. The highly practical value of the product has been demonstrated through actual use.

Other special concrete products which have been in the limelight during the past year include light-weight reinforced concrete roofing slabs (long span), precast floor slabs, reinforced concrete poles and lighting standards, telephone conduits, and related products.

Concrete Burial Vaults

Concrete burial vaults have continued their position as the most stable product in the entire industry. Aggressive merchandising, combined with quality of product, has resulted in keeping many a concrete products plant in operation during 1933.

As to the quality of concrete vaults, high-frequency vibration is playing a greater part in each succeeding year. This question formed the principal subject among the manufacturing problems discussed at the last annual meeting of the National Concrete Burial Vault Association; and it is receiving attention from the manufacturers of burial vaults molds.

An article by W. G. Kaiser, in the July (1933) issue of CONCRETE, pages 13 and 14, contains detailed information on mixtures for vibrated concrete used in the production of burial vaults. The June issue of CONCRETE, page 18, contains a valuable discussion of the extent of the prospective market for concrete burial vaults.

An outstanding new product in this field is the surface vault, described and illustrated on page 20 of the August (1933) issue of CONCRETE.

Unusual Types of Wall Construction

Several unusual types of wall construction were brought to the attention of the industry in 1933, designed for the most part to gain greater unity.

Two of these wall types, described in illustrated articles in the June (1933) issue of CONCRETE, page 14, and in the November issue, pages 7 and 8, are designed so as to combine them with job-placed concrete and with steel reinforcement, producing in effect a monolithic reinforced concrete wall.

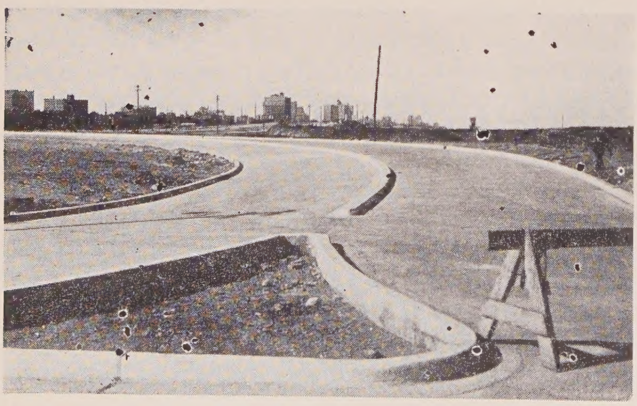
The April issue of CONCRETE, page 20, contains an illustrated description of a method of facing precast concrete building units with veneers of other material, such as limestone and burned clay. The February issue, pages 7 and 8, tells of an exceedingly attractive wall construction obtained through a combination of concrete back-up units, monolithic concrete, and rough quarry stone.

Cast Stone and Concrete Ashlar

The "aristocrats" of the concrete masonry industry—cast stone and concrete ashlar, have continued the substantial advances previously made.

During the year the members of the Cast Stone Institute solved their most difficult problem—that of establishing a working procedure whereby standard colors and finishes for cast stone may be specified by architects. Reference to this matter will be found on page 12 of the April (1933) issue of CONCRETE; and there, in turn, references are given to previously published articles.

Concrete ashlar units have become so well established in many sections that manufacturers regard them as their leading line. Because of the fact that not more than four different sizes are required, one of which may be the standard size, manufacturers have learned that the marketing of concrete ashlar is mainly a matter of merchandising.



Literature on Concrete Masonry

Space would not permit mention of all the useful literature now available to products manufacturers; but several publications that appeared during 1933 deserve special mention.

One of these was published by the Portland Cement Association, under the title of "Low-Cost Fireproof Concrete Homes." A review of this book appears on page 23 of the January (1933) issue of CONCRETE.

Another publication that should be in the hands of all products manufacturers is Bulletin No. 251 of the engineering experiment station, University of Illinois, which was issued in January, 1933, as a report of the wall-stability tests conducted at the university in 1931. A review of Bulletin No. 251 will be found on page 22 of the March (1933) issue of CONCRETE.

Reference should be made also to the various articles and reports on steam curing, mentioned on page 16 of the August (1933) issue of CONCRETE.

In addition, the book entitled "Facts About Concrete Masonry," though issued prior to 1933, must be mentioned. It is probable that most products manufacturers have copies of that book, but it is known that comparatively few have taken full advantage of it by placing personal copies into the hands of all architects in their trade territory. Copies for this purpose may be bought from the Portland Cement Association.

Outlook for 1934

The outlook for concrete masonry for 1934 may be gauged to the best advantage by consulting construction curves for 1933, observing the sharp upward trend of those curves in the late months of the year, and keeping in mind the part that concrete masonry and other concrete products should play in the construction work inaugurated through the PWA. On that basis the industry may build a solid hope—not an expectation that boom conditions will immediately return, but that 1934 will be much better than 1933.

White Cement Traffic Lane Curbs Guide Washington Motorists

WHITE cement concrete traffic lane leader curbs $2\frac{1}{2}$ in. deep and 6 in. wide have been made standard in the District of Columbia to indicate lines of travel.

A light colored sand is used in the mixture. The effective results being obtained are shown in the illustration.

Progress in Airport Improvements Demands Concrete Construction

4,000,000 Sq. Yd. of Concrete Pavement in U. S. Airports—Add 700,000 in 1933—Michigan and Kansas Cities Build Airports with CWA Labor

By E. K. SMITH
Assistant Manager, Highways and Municipal Bureau,
Portland Cement Association, Chicago, Ill.

THE steady increase in air traffic, including express and passengers, compared with reduction in so many other activities, emphasizes the value and the need for more and better airports. Concrete construction, durable and economical, has played an important part in the improvement of practically every important airport in the United States.

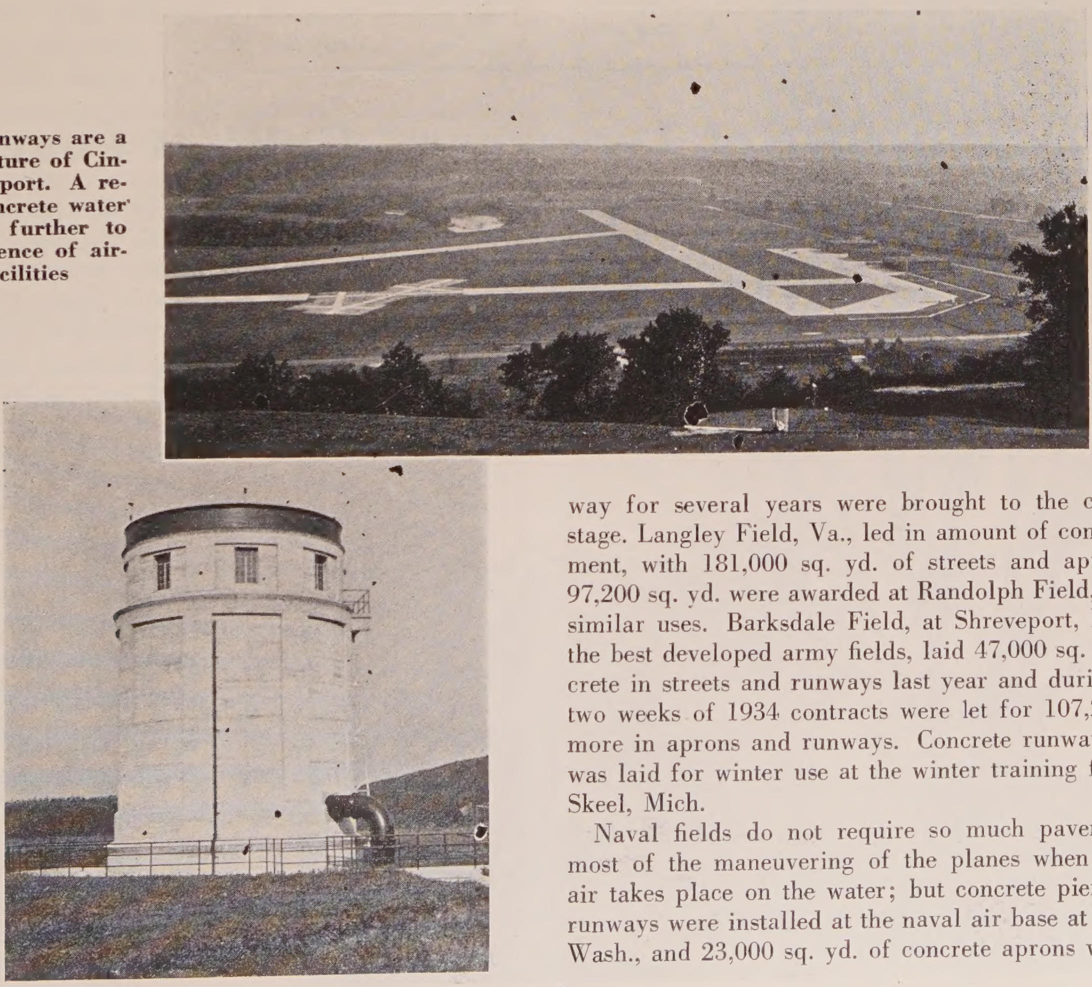
Nearly 4,000,000 Sq. Yd. of Concrete

Starting from scratch in 1928, there are today nearly 4,000,000 square yards of concrete pavement in service at airfields, public and private. Pavement uses include roads, streets, and sidewalks serving various parts of the field, wide aprons along the hangars and service buildings, two or three thousand-foot runways for landing and takeoff, and taxiways for the use of planes on the ground. A considerable amount of concrete has gone into hangars and administration buildings, field drainage, etc. Monolithic construction or block or tile has been used for hangars. The new barrel roof design is especially suited to hangar construction with wide spans.

The fear of a few years ago that tail skids would wear out too fast, or that planes might "ground loop" in landing on concrete, is outmoded by the increased use of brakes, and by equipping nearly all planes with a tail wheel or roller in place of the skid. The army maneuvers of 1931 demonstrated the value of wheel brakes in safely operating numbers of planes on restricted field surface.

Much Concrete Placed in 1933

Construction at U. S. army and navy fields was outstanding in 1933, as the developments planned and under way for several years were brought to the construction stage. Langley Field, Va., led in amount of concrete pavement, with 181,000 sq. yd. of streets and aprons, while 97,200 sq. yd. were awarded at Randolph Field, Texas, for similar uses. Barksdale Field, at Shreveport, La., one of the best developed army fields, laid 47,000 sq. yd. of concrete in streets and runways last year and during the first two weeks of 1934 contracts were let for 107,220 sq. yd. more in aprons and runways. Concrete runway pavement was laid for winter use at the winter training field, Camp Skeel, Mich.



Concrete runways are a popular feature of Cincinnati's airport. A reinforced concrete water tower adds further to the permanence of airport facilities

Naval fields do not require so much pavement, since most of the maneuvering of the planes when not in the air takes place on the water; but concrete pier slabs and runways were installed at the naval air base at Bremerton, Wash., and 23,000 sq. yd. of concrete aprons were placed at Corry Field, Fla. Similar improvements were carried on at a dozen more army and navy fields last year.

PWA Funds for Municipal Airports

Municipal and commercial field improvements included such items as more than three miles of 10-in. to 42-in. concrete pipe drains, at Shushan Airport, New Orleans, and 12,000 sq. yd. of concrete aprons at Candler Field, Ga., and Fort Worth, Tex.

Making a landing on a concrete runway at Ford Airport, Dearborn, Mich.

Rather late in the year cities began to realize that PWA funds were available for municipal airport improvement on the same basis as for other projects. Grants only, where the city will supply the other 70 per cent necessary, have already been announced for San Francisco ($53,000); Parkwater, Wash. ($27,000); Newark, N. J. ($22,000); and Columbus, Ohio ($4,400). Loans and grants have been announced for San Francisco ($260,000); Brunswick, Ga. ($105,000); and Wichita, Kan. ($66,000). The various projects include all classes of improvement, such as grading, drainage, paving and buildings.

Michigan and Kansas Cities Using CWA Labor

The federal Civil Works program also offers opportunities for city airports. A state-wide program is in effect in Michigan with CWA labor. In Michigan the major efforts are concentrated on opening new airports at cities which do not now have them. The governor of Iowa recently called a conference of city officials to establish a somewhat similar, state-wide program. Kansas cities are favoring permanent improvements. Kansas CWA projects include one at Topeka, a new hangar with concrete floor; Lawrence, a concrete floor in the hangar; Hutchinson, concrete aprons; Salina, a concrete box sewer and aprons; Goodland and Chanute, repair jobs; and a $12,800 expenditure for labor and material at Hays, Kansas.

Durable Construction Reduces Field Maintenance

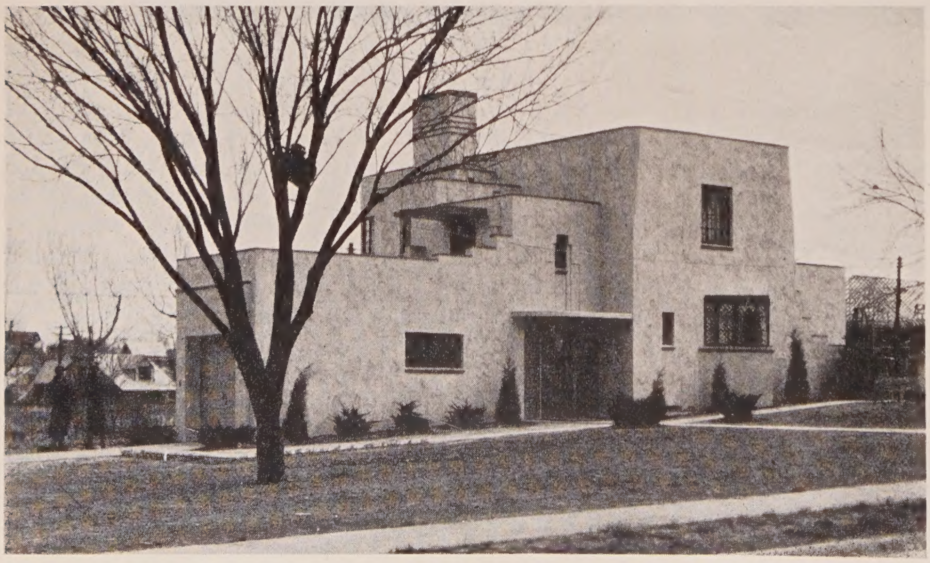
The public has demonstrated confidence and satisfaction with transportation by air by steadily increasing use. Concrete paving and durable construction for buildings and accessories greatly reduce the field upkeep, which is always an important part of operating costs, besides greatly increasing the safety and convenience of the field for all planes using it. If cities will take full advantage of funds that may be available for public works or civil works, the record established by 700,000 sq. yd. of concrete pavement laid at United States airports in 1933 may well be exceeded in 1934.

Omaha's "House of Tomorrow" Built of Concrete

AN all-concrete house, with first, second and third floors built of precast reinforced concrete joists without ceiling plaster, has been built as a demonstration house by the Junior Chamber of Commerce, of Omaha, Nebraska. The walls are of concrete masonry, and the exterior is coated with cement stucco.

Originally this "House of Tomorrow" was planned to be built of pre-fabricated steel. To the concrete products manufacturers of Omaha and to C. W. Hiner, of the Lincoln office of the Portland Cement Association, belongs much of the credit for the change in plans. Construction, decorating and furnishing were completed in eight weeks.

R. F. Hennig, of Omaha, is the architect who designed this splendid example of fireproof home construction.



Omaha's "House of Tomorrow" is all concrete. R. F. Hennig, Omaha, is the architect. During the four days following the formal opening to the public more than 4,000 visitors inspected this fireproof home

Housing Projects to the Front in 1934

Concrete Construction Will Permit Low Cost Without Cheapness—Public Sold on Fireproof Homes

TO many it seems incredible that residential construction should begin an uptrend at this stage of recovery; but one whose memory runs back to 1921 will recall the fact that residential construction was the first to start the climb out of the depression of the early twenties.

Awarded Contracts Tell Story

The uptrend in residential construction is far more than a hope—it is an accomplished fact. It has been noted repeatedly in the F. W. Dodge reports of contracts awarded in the 37 states east of the Rocky Mountains—and the latest report is more optimistic than any of its predecessors.

Where Housing Markets Lie

The residential construction market in 1934 arises mainly from three sources; and the existence of the market is due primarily to the accumulated home shortage caused by the great reduction in home construction since 1929. This shortage becomes more and more evident as doubled-up families continue to unscramble and again occupy separate homes. Another important factor is the rapid increase in marriages, many of which had been postponed because of the depression. To make up this shortage, the following three types of residential construction will be most in evidence in 1934:

(1) Low-cost single-family homes built by individual families, at prices ranging from $3,000 to $7,500.

(2) Subsistence homesteads, for the promotion of which the federal government has set aside $25,000,000.

(3) Slum-clearance projects, financed in part by the federal government through the PWA.

Privately Built Homes

Homes built by or for private families for their own use must fall in a range of cost somewhere between $3,000 and $7,500 if the large market in this field is to be reached. Several facts must be taken into consideration. In the first place, the home must be attractive in appearance, and the lot, however small, must be appropriately landscaped. Second, these families will be content if conveniences are provided—they are willing to forego the luxurious features of the roaring twenties. And finally, the home-owning public has been rather thoroughly sold on the advantages of the fireproof home.

Planners of low-cost homes will, therefore, make a grievous mistake if they think of low cost in terms of "cheapness" or flimsiness. To obtain low cost without cheapness or flimsiness requires careful planning, backed by a thorough knowledge of building materials and their use.

An excellent book on "Low-Cost Fireproof Homes," reviewed on page 23 of the January (1933) issue of CONCRETE, may be obtained, on request, from the Portland Cement Association.

The subsistence homestead is another form of residential construction that is encouraged and aided by the federal government. In these projects each individual home is built on several acres of land, with the view of permitting the family to grow a considerable part of its food supply. The entire project is planned as a self-contained community. It must, of necessity, be located near places of employment—that is, within driving distance of industrial plants and mercantile establishments.

The first government-aided subsistence homestead project was started in November, 1933, near Arthurdale, W. Va. The illustration shows workmen laying concrete masonry foundations for one of the buildings, during an inspection trip by Mrs. Roosevelt, who is seen in the picture.

Mrs. Roosevelt inspects subsistence homestead project in West Virginia. Foundation walls are of concrete masonry

A second subsistence homestead project has been started near Dayton, Ohio, and a third near Decatur, Indiana, both aided by government funds.

Slum-Clearance Projects

Slum-clearance projects constitute a third important phase of residential construction—and, unfortunately, these projects involve much capital, much attention to legal matters because of the large number and complex character of property owners concerned, and much planning and organization. In spite of these difficulties, some important projects of this type are actually in process of construction.

Suggested plans for a slum-clearance project are shown and discussed in an article in the July (1933) issue of CONCRETE, pages 6 and 7.

With residential construction definitely on the increase, it is the sincere hope of all that the construction industry may avoid the tragic errors of the early twenties, when the great era of jerry-building was in full bloom.

The American Concrete Institute Convention Program

To Be Held at the Royal York Hotel, Toronto, Canada, February 20, 21 and 22

MANY excellent papers are definitely scheduled for the 30th annual convention of the American Concrete Institute, to be held at the Royal York Hotel, in Toronto, Canada, on February 20-22, 1934. It is expected that several additional papers will be lined up for presentation, but the complete program will not be announced until about ten days prior to the convention.

R. B. Young is chairman of the Toronto Convention Committe of the A. C. I., but members of the Engineering Institute of Canada, of the Ontario Association of Architects, and of the Toronto Building and Construction Association are co-operating to the fullest extent, to insure the success of the convention. The convention program, it is now known, will include the papers here mentioned:

The Convention Program

John J. Early, who at the 1933 convention presented an introductory paper on the problems of providing a reinforced concrete covering for Baha'i Temple, Wilmette, Ill., will present a paper on the solution of the problems involved in designing, casting, finishing and erecting the dome covering of precast white quartz concrete sections weighing several tons each, with provisions for discounting volume change. Mr. Earley's paper will be addressed to architects. It will consider not only the Baha'i Temple work but another noteworthy application of concrete, in high color, to the ceilings of the new Department of Justice building in Washington, D. C. This work is under way. In his plastic mosaic, Mr. Earley is no longer hampered by limitations of color in aggregate. By reason of advanced technique in the control of color in burning ceramic materials and in the production of glass, both of which materials he uses for aggregates, Mr. Earley's palette is now equal to demands of architects even in the present advanced state of modern architectural requirement of high color.

Walter T. Steilberg, architect and architectural engineer, Berkeley, Calif., has been active in his study and use of concrete as a structural-architectural material. He will discuss the architecture of concrete structures, studies of cracking of reinforced concrete structures and the design of structures to resist earthquake—attempting, in these three divisions of his subject, to answer questions arising in his own experience—questions which are no doubt in the minds of many architects considering the best use of concrete.

Architectural Exhibit.—The lively interest evident in the architectural exhibit at the convention in Chicago last February has suggested doing something more along similar lines at Toronto. Again the display of photographs and specimen panels for color and finish of concrete will be sponsored by Institute Committee 409 on Recommended Practice in Architectural Monolithic Concrete Construction. Mr. Earley (a member of the committee) proposes also to show units of the Department of Justice ceilings.

Precast Concrete Floor Joists.—Of interest not only to architects but to concrete products manufacturers are developments in the design and test of light-weight concrete floor joists which will be reported from an investigation in the research laboratory of the Portland Cement Association.

S. B. Morris, chief engineer and general manager, and Ross White, formerly construction engineer, Pasadena Water Dept., will report special features of interest in making and placing concrete on Pine Canyon dam.

Winter Concreting.—A fresh approach will be made to the whole matter of winter concreting. From the Portland Cement Association laboratory will come a report of laboratory studies to clarify this subject. *R. B. Young* and *Wilfrid Schnarr* of the Hydro-Electric Power Commission of Ontario, will present two papers, one based on discussion of fundamentals of heating concrete, the other its protection when placed.

Prof. Raymond E. Davis, University of California, will report results of studies of bonding new to old concrete.

Prof. H. M. Westergaard, University of Illinois, whose paper "Stresses at a Crack, Size of the Crack and the Bending of Reinforced Concrete" appears in the November-December (1933) issue of the A. C. I. *Journal,* will make a brief convention presentation of the principles of his study, involving a new conception of stress distribution in beams that he has been developing for several years.

Prof. S. C. Hollister, Purdue University, has proposed polarized light studies along similar lines, but a report of these studies for the convention is not now definitely assured.

Prof. F. E. Richart, University of Illinois, will present the results of studies of plastic flow in reinforced concrete frames.

J. Morrow Oxley, of Chapman and Oxley, architects and engineers, Toronto, will present outstanding features of Toronto's new building code as they have a bearing on concrete construction—and there are numerous features of interest to concrete makers and code makers everywhere.

Prof. Inge Lyse, Lehigh University, whose paper "Durability of Concrete and of Aggregates" appears in the November-December (1933) issue of the A. C. I. *Journal,* will make a convention presentation of the subject. Other discussions of factors in concrete durability will be presented.

Robert Kinzie, Jr., research chemist, Santa Cruz Portland Cement Co., is collaborating with *R. W. Carlson* and *R. E. Davis,* University of California for the presentation of results of studies at the University and in the Santa Cruz laboratory on high silica cements.

A. S. C. E. in Eightieth Annual Meeting

THE eightieth annual meeting of the American Society of Civil Engineers, held in New York City on January 17-20, heard several important papers and reports pertaining to the concrete construction industry.

W. G. Sloan, state highway engineer, Trenton, N. J., presented a paper on the design and construction of the New Jersey state highway approach to Holland Tunnel.

C. T. Morris, professor of structural engineering, Ohio State University, presented the report of the Committee on Concentrated Loads on Concrete Slabs. Prof. Morris also presented a report of the Committee on Concrete and Reinforced Concrete Arches.

Medal Awards.—Among the medals awarded, several were given for meritorious work related to design of reinforced concrete structures. These include the Norman Medal, awarded to Hardy Cross, professor of structural engineering, University of Illinois, for his paper on "Analysis of Continuous Frames for Distributing Fixed-End Moments." The Collingwood Prize for Juniors was awarded to Bernard L. Weiner, of New York, for his paper on "Design of a Reinforced Concrete Skew Arch."

Honorary membership in the society was conferred on F. E. Turneaure, dean of the college of mechanics and engineering, University of Wisconsin.

Headquarters offices of the American Society of Civil Engineers are at 33 West 39th Street, New York.

EDITORIAL

Court Decisions Favor Recovery Measures

SEVERAL recent court decisions have given recognition to the emergency character of the recovery efforts of the national administration.

One of the decisions—that of Judge Claude N. Saum, of the Iroquois County (Illinois) circuit court—brought to an end the activities of a small group who attempted to block work on CWA construction projects on the ground that materials had been purchased without going through the legal formalities of taking competitive bids. The petitioners did not claim that prices paid were excessive.

In his decision denying an injunction, Judge Saum recognized the present emergency as tantamount to that of a war emergency, and in discussing the recovery acts passed by the last Congress he said: "We are confronted with an emergency practically unprecedented in the history of our country, and the court is of the opinion that the effect of these acts should operate as a suspension of any laws of the state or rules regulating the government of municipalities where such laws or regulations are in conflict with the spirit of such recovery acts."

Another important court decision was that of the United States Supreme Court, handed down on January 8 and, in effect, upholding the Minnesota state law suspending real estate mortgage foreclosures. While this decision has no direct effect on construction, it does have a very important bearing on the entire recovery program, for it, too, recognizes the emergency character of this state law.

These two decisions—one coming from the highest judicial body, and the other from a lower court—give no encouragement to the interests who, for selfish reasons, would sabotage the entire recovery program.

Airports as PWA and CWA Projects

IN Michigan a state-wide program has been inaugurated for the construction of municipal airports as CWA projects, in cities that have no airports.

The governor of Iowa recently called a conference of city officials to establish a similar program in that state. A number of cities in Kansas are utilizing CWA labor in the improvement of existing airports, this work including the construction of additional hangars, the repair of old buildings, the placing of concrete floors, aprons, walks and runways, and the installation of drainage and sewer systems.

Many other municipalities are either building, or preparing to build, airports by utilizing PWA funds. As pointed out by E. K. Smith in an article in this issue of "Concrete," airports offer excellent opportunities to concrete contractors for worth-while contracts. In 1933 no less than 700,000 sq. yd. of concrete pavements were placed in runways and aprons. In addition to paving, airports required the construction of buildings, sidewalks, lighting systems, drainage systems, field markers, and parking space.

Where CWA labor is used, cement-bound macadam offers opportunities for airport paving.

Regardless of the source of the funds, cities will find few better ways to spend these credits.

Drastic, but Justified

SECRETARY ICKES, public works administrator, has taken drastic action against slackers in the drive toward reemployment through the PWA.

He has revoked a number of construction allotments where local jealousies, or official indifference, or any other inexcusable causes, prevented the projects from going ahead. The funds thus released, amounting to about fifty million dollars to date, were immediately reallotted to projects that were ready to go ahead.

These are drastic measures, but they are justified. Only in this way can a certain type of local public officials be prodded into action. The danger of further revocation of allotments will have the effect of bringing dilly-dallying to an end and getting a vast volume of construction work under way at once.

Products Men Talk Business Again

MANUFACTURERS of concrete products see better times ahead.

Local associations are everywhere getting together in meetings, to discuss markets and sales campaigns for 1934, and to talk about the NRA code.

Meetings held in January and scheduled for early February include gatherings at Boston, Rochester, Newark, Philadelphia, Washington, D. C., Freeport, L. I., Williamsport, Penna., Milwaukee, Minneapolis, Des Moines, Omaha, St. Louis and Kansas City.

This revival of interest is not based on prospects alone. It is based in part on actual improvement.

Road Builders Look Ahead

THE annual convention of the American Road Builders' Association has come to a close, but the work of this great association never ceases.

Boiled down to their most condensed form, the objectives of the association may be stated in simple form—first, continuation of adequate annual highway programs by states and counties; second, continued federal appropriations for highway construction; and third, conserving gasoline tax and motor revenues for highway construction and maintenance.

This contribution from the A. R. B. A. will be a powerful influence toward recovery.

PROGRESS—In a Page

Current activities in research, in matters pertaining to concrete and cement, as being carried on or completed by various organized groups.

Short Courses in Public Works Construction

FOUR new short courses, giving training in construction methods in connection with public works projects, have recently been prepared by the extension division of the University of Wisconsin. The four types of work covered include construction of highways, construction of sewers, construction of water supply systems, and plain concrete construction.

These courses are taught by the correspondence-study methods for men resident in any part of the country. They are described as of benefit to foremen and assistant foremen, and as having special reference to the needs of men who will be engaged in national recovery projects.

The courses were prepared by the extension department of civil and structural engineering, in charge of Prof. H. E. Pulver.

How Concrete Vibrators Are Specified

SPECIFICATION writers will be interested in the wording of the paragraph in Standard Specifications for Concrete Work, U. S. Veterans Administration, Washington, D. C., in which the requirements for high-frequency concrete vibrators are specified. The paragraph in question reads:

"Concrete shall be compacted with a mechanical ram or vibrator. This machine shall be of an approved type, and where placed in concrete it shall give not less than 4,000 vibrations per minute in all directions on a horizontal plane. The portion of the machine producing vibrations shall not be secured to forms or reinforcing steel, and when placed in concrete it shall be operated in one place for approximately thirty seconds or until a concrete of maximum density is produced. Forms shall not be displaced or reinforcement disturbed by the vibrator."

Bureau of Standards Continues Work on Cement and Concrete

THE U. S. Bureau of Standards, Washington, D. C., continued throughout 1933 its various investigations pertaining to cement and concrete.

Studies of the fundamental properties of cement have been continued. The effect of calcium chloride on the strength and other properties of cements is being determined. Isothermal calorimeters for the determination of the heat of solution of anhydrous and hydrated cement have been constructed for use in testing cement for Boulder Dam and for general research work in the hydration of cement.

Compressive strength tests of concrete at the age of 1 year have been completed on 12 high-early-strength cements; 6 by 12-in. cylinders were but slightly affected by 300 cycles of freezing and thawing; 3 by 6-in. cylinders subjected to alternate freezing, thawing, and drying gave strengths considerably below normally-cured specimens, with spalling taking place in some cements after about 30 cycles of drying and freezing.

The investigations of the Portland Cement Association Fellowship have been continued along two fundamental lines: (1) the establishment of the constitution of cement clinker and the effect of constitution on cement properties, and (2) the control of the reactions of cement during setting and hardening. These studies provide information upon which may be based the design of concrete, either to meet special requirements or to meet more rigid criteria for durability or architectural versatility.

A branch laboratory has been established at Riverside, Calif., to test cement for Boulder Dam. Other branch laboratories of the Bureau of Standards are located at Northampton, Penna., at Denver, Colo., and at San Francisco, Calif.

Tests on Reinforced Concrete Arch

A 32-PAGE illustrated report on tests made on one of the reinforced concrete arches of Arlington Memorial Bridge appears in the November (1933) *Journal of Research* of the U. S. Bureau of Standards, Washington, D. C.

The tests were made to determine changes in the temperature of the concrete, deflections, and deformations accompanying changes in temperature and in loading. Observations were made both during construction and after completion.

Effects due to removal of the centering from a portion of the arch barrel, and to addition of the superstructure loads, as well as effects due to shrinkage and time-yield, are shown and discussed in the report. The coefficient of thermal expansion of the arch was determined.

Federal Specifications for Bar Reinforcement

THE Federal Specifications Board, Washington, D. C., has officially adopted a federal specification for bar reinforcement for concrete, which becomes mandatory upon all departments and independent establishments of the government on January 1, 1934.

Copies of the new specification, which carries the symbol QQ-B-71, may be obtained at 5 cents each from the Superintendent of Documents, Government Printing Office, Washington, D. C.

List of A. S. T. M. Standards

THE LIST of A. S. T. M. Standards and Tentative Standards, as of September 1, has been printed and copies of the pamphlet will be sent without charge on request addressed to the A. S. T. M. at 260 South Broad St., Philadelphia. The standards and tentative standards are listed according to the materials to which they apply, and the groups are further subdivided under the headings *Specifications, Methods of Testing, and Definitions.* An alphabetical table of contents has been added to the pamphlet to facilitate its use.

Co-ordination of Basic Principles of Concrete Mixtures

Study of Criteria of Mixtures for Skilled Control of Concrete Comprises Thirteenth Article of Series—Law of Cement Content Amplified

XIII—Supplementary Principles and Co-ordination

By JOSEPH A. KITTS
Consulting Concrete Technologist, San Francisco, Calif.

THE previous chapters,[1] reviewing various researches of concrete mixtures made in the past half century, have brought forth principles of mixture formulation which provide bases for the six laws of mixtures specified in Chapter IV (CONCRETE, August, 1932) as requirements in the central plant manufacture of concrete to supply commercial demand. The following paragraphs will supplement these principles and co-ordinate them with the very comprehensive and well-founded criteria of mixtures published by the Portland Cement Association in "Design and Control of Concrete Mixtures" (Second Edition, January, 1927), and will give attention particularly to the criteria of mixtures for skilled control as illustrated by Curve A of Figure 1 and the diagrams of Figure 12 in that publication.

No Absolute Criteria of Mixtures

These criteria of mixtures of the Portland Cement Association are not absolute for all conditions of cement and aggregate quality and of technological control. This is shown for technological conditions by their criteria of cement contents for skilled control of strength of mixtures in comparison with that for ordinary control. Comparisons of cement contents for ¾ in. maximum size of aggregate and 6 to 7 in. slump are as follows, as an example:

	Sacks of Cement per Cu. Yd.		Excess for
Required Strength	Skilled Control	Ordinary Control	Ordinary Control Per Cent
1,500	4.6	5.4	17
2,000	5.5	6.7	21
2,500	6.6	8.1	23
3,000	7.9	9.9	25
3,500	9.5	12.2	27
4,000	11.4	14.9	30

Strength values, for given cement, water and aggregate content of mixtures, have been shown in the previous chapters as varying with cement and aggregate quality, grading of aggregate mixture, time of mixing, temperature and moisture of curing, and with skill of control.

Better results may be obtained today than indicated in 1927 by the Portland Cement Association for skilled control, provided the improved technological facilities of the central plant are employed with an improved knowledge of the physics of mixtures. Weighing batchers, water meters, and transit mixers have no more intelligence than shovels, buckets and barrows, and ordinary control of central plant facilities may be expected to produce no more than ordinary results.

Modern portland cement of a given brand is usually very uniform in its strength-producing effect in concrete, if not deteriorated by exposure to moisture. Normal standard portland cement is a very uniform product but some brands have better strength-giving efficiency in concrete than others. Further, there are super-portlands, high-early-strength portlands, high-silica cements, etc. The particular brands of cement being used need to be evaluated for the given aggregates and technological conditions.

Must Maintain Absolute Volume Basis

Given cements and aggregates of uniform strength-producing quality, the aggregates will naturally vary from day to day in shape, specific gravity, density, fineness modulus, grading, moisture content, and absorption. Under these conditions a concrete mixture, of given measures (weight or volume) of aggregates, cement and water, will vary greatly in coarseness, grading, workability, density, water-cement ratio, cement content per unit volume of concrete, and, likewise, in strength. No automatic device can have the intelligence to correct these conditions. Uniformity of strength, density and workability of concrete, under given conditions of cement and aggregate quality, depends upon maintenance of the basic mix structure in absolute volume contents of cement, mixing water, and aggregates of a fixed grading of particles from fine to coarse. This requires constant laboratory testing of the aggregates, for specific gravity, density, moisture content, absorption and grading, and corresponding readjustments of the measured proportions as the physical characteristics of the aggregates vary. Where the strength-producing qualities of the materials vary, a more extensive laboratory control is necessary.

Criteria of mixtures for well-rounded gravel aggregate of nearly spherical particles are not suitable for elongated or angular particles, as the irregular shaped particles require a finer grading and greater amounts of mixing water and cement for a given workability and strength.

In view of the foregoing and other complex elements affecting the strength of concrete, there are no fixed proportions or formulas of mixtures which are absolute criteria under all conditions. It should be understood that the 1927 Portland Cement Association criteria for carefully controlled mixtures, forming the bases of the following analyses and definite equations of the six specified laws of mixtures, are employed only to present a substantial example of the interrelations of mixtures—of various cement contents, water contents, maximum sizes and fineness moduli of the aggregates, and slumps of the concretes—under given conditions of materials, proportioning control, mixing, placing and curing.

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[1] Published in CONCRETE in issues from May, 1932, to April, 1933.

Basic Conditions for Mixture Criteria Employed

The Portland Cement Association 1927 criteria of mixtures, employed herein, are based on the following conditions of material character and quality, proportioning control, mixing, placing and curing:

1. Normal standard portland cement, 1918-1927 quality.
2. Rounded gravel aggregates and sand of standard quality.
3. Potable water.
4. Maintenance of the given fineness modulus of the mixed aggregate.
5. Accurate maintenance of the given water-cement ratio with corrections for the water contents and absorption of the aggregates.
6. Accurate measurements of aggregates, cement and water.
7. Machine mixing for 1 to 1½ minutes while all the ingredients are in the mixer.
8. Standard molding, capping, curing and testing of sample cylinders.
9. Accurate field and laboratory tests of materials and mixtures, as required by the preceding items.

The word "standard" used here designates the corresponding A. S. T. M. standards of 1927.

Practical Tables and Application

Tables of practical constants, for the six co-ordinated laws of mixtures, based on the Portland Cement Association criteria of 1927, are given by the author in "Co-ordinated Laws of Concrete Mixtures and Their Application," CONCRETE, November and December, 1931. Those tables and their application show a preview of the results of the studies presented herein and are properly supplementary to these chapters. The tables and applications will not be repeated, but the manner of determination and co-ordination of the law constants will be explained in the following paragraphs.

(I) LAW OF THE CEMENT CONTENT

The P. C. A. 1927 criteria show in Figure 12 four diagrams illustrating mixtures of four slump classifications—¾, 3½, 6½, and 9 in. Cubic feet of dry-rodded bulk volume of mixed aggregate per sack (94 lb.) of cement are shown as ordinates and fineness moduli as abscissas, both in natural scale. Each slump diagram shows curves for strengths of 1,500, 2,000, 2,500, 3,000, 3,500 and 4,000 lb. per sq. in. at 28 days, also transverse curves for ¾, 1, 1½, 2 and 3-in. maximum sizes of aggregates. The points of intersection of the strength and aggregate size curves comprehend 30 mixture combinations for each slump classification; and innumerable combinations of strength, maximum size and slump, may be obtained by interpolation.

As a matter of essential expediency in ready-mix production it is necessary to know the absolute volume of cement per unit volume of concrete, for any of probable combinations of mixture specifications in maximum size, strength and slump. As normal standard portland cement is uniform in specific gravity, and pounds per cubic yard is the American practice of measurement in ready-mix production, it is a practical necessity to state the cement content in pounds per cubic yard of concrete. The cement contents indicated by the criteria are as given in Table 10.

TABLE 10.—POUNDS OF NORMAL STANDARD PORTLAND CEMENT PER CUBIC YARD OF CONCRETE FOR GIVEN STRENGTHS, MAXIMUM SIZES OF AGGREGATES, AND SLUMPS, UNDER SKILLED CONTROL

Based on Figures 12 and 15, "Design and Control of Concrete Mixtures," Second Edition, 1927, by Portland Cement Association.

Strength at 28 days, lb. per sq. in.	Maximum Size of Aggregates, in Inches				
	¾	1	1½	2	3
		¾ in. Slump			
1,500	320	291	267	249	245
2,000	378	343	322	292	270
2,500	454	418	384	353	322
3,000	522	494	458	419	386
3,500	611	569	531	494	458
4,000	714	673	635	574	546
		3½ in. Slump			
1,500	362	329	303	278	254
2,000	437	395	367	334	310
2,500	522	480	447	405	378
3,000	611	564	522	480	447
3,500	696	658	611	569	541
4,000	833	785	724	682	649
		6½ in. Slump			
1,500	433	395	367	329	301
2,000	517	479	452	414	376
2,500	630	583	546	508	462
3,000	724	696	649	611	555
3,500	865	818	790	715	668
4,000	1,100	1,035	950	894	828
		9 in. Slump			
1,500	555	517	470	442	405
2,000	686	630	592	545	498
2,500	808	771	714	677	630
3,000	997	959	894	837	790
3,500	1,280	1,230	1,185	1,100	997
4,000	1,570	1,532	1,505	1,430	1,365

Note: While the quantities of Table 10 are taken off the graphs with special care, they naturally reflect probable errors in the original data, in the graphs, and in the reading of the graphs, sometimes accumulative and sometimes compensating. Therefore, the values are not consistent one with another and need to be adjusted by graphical and mathematical analysis.

Graphical Analysis of Laws of Cement Content

Taking the cement contents of Table 10 for a given maximum size and slump, and plotting pounds of cement per cubic yard to logarithmic scale as ordinate, against strength to natural scale as abscissa, the points for the six strength values fall in practically straight lines. Therefore, the equation of cement content for any strength, for the given maximum size of aggregate and slump of concrete, is—

$$\log C = BK_s + A \quad . \; . \; . \; . \; . \; . \; . \; (38c)$$

in which C is pounds of cement per cubic yard of concrete, K_s is the compressive strength of the concrete at 28 days of age, and B and A are constants (applying only to this equation)* depending upon the maximum size of aggregate and slump of concrete.

Plotting the graph for each size of aggregate for a given slump of concrete, the five graphs naturally converge from a low cement content to a common intersection of all cement mortar of the given slump. Unfortunately, the amount of cement required, per cubic yard of neat cement mortar of the given slump, is not established, but 2,538 to 3,000 lb. of cement may be taken as the point of intersection without appreciable error in the usual proportions. These graphs also show at a given cement content that the differences in strength are equal between ¾ and 1½, 1 and 2, and 1½ and 3 in. As these sizes are in the same logarithmic ratio, it follows that the strength for a given cement content and slump varies as the logarithm of the maximum size of the aggregate. That is—

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*The notation used herein applies only to the particular subject and does not have the same meaning throughout.

$$\log D = mK_s + n \quad . \; . \; . \; . \; . \; . \; . \; . \; . \quad (49)$$

$$\text{or} \qquad K_s = (\log D - n)/m \quad . \; . \; . \; . \; . \quad (49a)$$

in which D is the square-hole maximum size of the aggregate, and m and n are constants depending on the cement content and slump.

Graphs are quite necessary to show the types of curves and relations of curves for one condition to the curves for other conditions. Rectangular, semi-log, and log-log co-ordinate paper are most essential facilities of concrete research. Graphical analysis, however, depending as it does on visual, manual and mechanical limitations, must be supplemented by the mathematical "method of least squares" in order to arrive at the most probable values of constants of the curve equations. Having determined the equations by the method of least squares, convenient tables of consistent values may be computed.

Cement Equations by Method of Least Squares

Taking the first set of values in Table 10, we can write the following approximate equations for ¾-in. maximum size of aggregate and ¾-in. slump, in accordance with Equation (38):

$$\begin{array}{ll} \text{Cement} & \text{Strength} \\ \log 320 = 2.50515 = & 1{,}500\ B + A \\ \log 378 = 2.57749 = & 2{,}000\ B + A \\ \log 454 = 2.65706 = & 2{,}500\ B + A \\ \log 522 = 2.71767 = & 3{,}000\ B + A \\ \log 611 = 2.78604 = & 3{,}500\ B + A \\ \log 714 = 2.85370 = & 4{,}000\ B + A \end{array}$$

Adding these equations together, we obtain the equation—

$$16.09711 = 16{,}500\ B + 6A$$

$$\text{or} \quad 2.68285 = 2{,}750\ B + A \quad . \; . \; . \; . \; . \; . \; . \quad (I)$$

Multiply each equation by its coefficient of B and adding the results together, we obtain the equation—

$$44{,}874.305 = 49{,}750{,}000\ B + 16{,}500\ A$$

$$\text{or} \quad 2.719654 = 3{,}015.1515\ B + A \quad . \; . \; . \; . \; . \; . \; . \quad (II)$$

Solving these two equations (I and II) for A and B, we have—

$$A = 2.30115$$

$$B = 0.0001388$$

In the same manner, sets of values of A and B, for the five sizes of aggregates and four slump classifications, are obtained as shown in Table 11.

TABLE 11.—TENTATIVE VALUES OF *A* AND *B*, EQUATION 38. BASED ON TABLE 10

Slump, Inches		Maximum Size of Aggregates, in Inches				
		¾	1	1½	2	3
¾	A	2.30115	2.24862	2.20742	2.17364	2.14956
	B	.000139	.000146	.000149	.000148	.000146
3½	A	2.35814	2.30012	2.26902	2.21499	2.17029
	B	.000140	.000149	.000148	.000155	.000160
6½	A	2.40949	2.35767	2.32646	2.27982	2.23096
	B	.000153	.000162	.000163	.000167	.000171
9	A	2.46818	2.41883	2.36458	2.33444	2.28875
	B	.000181	.000191	.000201	.000202	.000206

Plotting the values of A, for a given maximum size, against slump, both to natural scale, it is evident that the values are not consistent. However, the points fall into essentially straight lines, indicating that the values of A for a given maximum size of aggregate should vary uniformly with the slump, or—

$$A = m \text{ Slump} + k \quad . \; . \; . \; . \; . \; . \; . \; . \quad (50)$$

in which m and k are constants depending on the particular maximum size. Plotting A to natural scale against maximum size to logarithmic scale, for a given slump, the points fall into essentially straight lines and indicate that A for a given slump varies inversely as the logarithm of the maximum size of the aggregate, or—

$$\log D = n\,A + f \quad . \; . \; . \; . \; . \; . \; . \; . \quad (51)$$

in which f and n are constants depending on the particular slump.

Substituting in Equation (50) the tabular values of A for a given maximum size, and employing the given method of least squares, constants m and k may be obtained for the given maximum size, and, in the same manner, for the other maximum sizes, thus providing an Equation (50) for each of the five maximum sizes of aggregates. From these equations, adjusted values of A may be obtained for each maximum size at 0 and 10-in. slumps. Substituting in Equation (51) the logs of the respective maximum sizes and these adjusted values of A for 0 slump and employing the method of least squares, constants n and f are obtained, from which the finally adjusted values of A may be determined for any maximum size for 0 slump, and, in the same manner, for 10-in. slump. Knowing the value of A for both 0 and 10-in. slump for a given maximum size, the values at 1, 2, 3, 4, 5, 6, 7, 8, and 9-in. slumps vary uniformly between the 0 and 10-in. values. Thus, we have means of determining A for any desired maximum size and slump.

Taking these finally adjusted values of A for any slump and maximum size of aggregate, in connection with the cement content and strength of neat cement mortar of the particular slump, the values of B for each maximum size are determined by using the corresponding values in Equation (38c), in which—

$$B = (\log C - A)/S \quad . \; . \; . \; . \; . \; . \; . \quad (38d)$$

Table 12 gives cement contents indicated by our experience for mortars of various slumps; also, the corresponding strength values, based on the original constants A and B in Table 11, and interpolated values for slumps of 0 to 10 in.

TABLE 12.—PROBABLE STRENGTHS AND CEMENT CONTENTS OF NEAT PORTLAND CEMENT MORTAR OF VARIOUS SLUMPS

Strength values based on Equation (38) and Table 11. Cement contents include allowance for shrinkage in initial set.

Standard Slump in Inches	Portland Cement per cu. yd., in lb.	Compressive Strength, Lb. per Sq. In. at 28 days	
		By A and B in Table 11	By Interpolation and Adjustment
0	2,900		8,700
¾	2,870	8,530	
1	2,860		8,500
2	2,820		8,280
3	2,780		8,030
3½	2,760	7,835	
4	2,740		7,720
5	2,700		7,380
6	2,660		7,000
6½	2,640	6,755	
7	2,620		6,500
8	2,580		5,940
9	2,540	5,255	5,260
10	2,500		4,500

Having determined satisfactorily uniform A values in the manner previously described, and, also, the cement contents and strengths of neat cement mortars as in Table 12, the B values may be determined by Equation (38d), as in the following example:

EXAMPLE:
Required: B values in equation $\log C = BK_s + A$
For: ⅞ in. maximum size of aggregate
8 in. slump
Given: $A = 2.4344$ (assumed adjusted value)
$C = 2580$ lb. (by Table 12)
$K_s = 5940$ lb. per sq. in. (by Table 12)
Then by Equation (38d):
$B = (\log 2580 - 2.4344)/5940$
$= .0001645$

Original Analysis Recommended

The foregoing methods of determination of the values of A and B from the original data, and of adjustments for uniformity, are more thorough than those employed in the determination of Table 2, p. 14, CONCRETE, December, 1931, and independent determinations should be made throughout from the original data. The extrapolated values of Table 2 (above 3 in. and below ¾ in. maximum size) are based on Equation (51). It is characteristic of the semi-log equation that as you approach the smaller dimensions (less than ¾ in. in this case) the equation shows plus values and, therefore, the extrapolated values for less than ¾ in. maximum indicate an excess of cement.

Advantages of Cement Content Laws

Having derived the A and B values of Equation (38) for any maximum size of aggregate and slump, convenient tables of cement contents for 1,000 to 6,000 lb. strength may be prepared.

In concrete research with new materials and conditions, the important value of the laws of cement content, represented by Equations (38), (50) and (51), is that determination of cement contents and strengths of neat cement mortars, in four slumps, and of concretes of two maximum sizes and two slumps, a total of eight mixtures, provides sufficient data of cement contents for all practicable limits of maximum sizes, strengths and slumps of concrete.

These laws, however, are not independent of the water contents and aggregate gradings.

(To be continued)

American Concrete Pipe Association Meets in February

THE American Concrete Pipe Association will hold its annual meeting at the Edgewater Beach Hotel, Chicago, on February 23 and 24. The industry's code of fair competition will be one of the subjects under discussion.

M. W. Loving, 33 W. Grand Ave., Chicago, is secretary of the association.

Reinforcing Steel Institute Meeting

THE Concrete Reinforcing Steel Institute will hold its annual meeting in Chicago on March 15 and 16. The program for the meeting has not as yet been formulated, but information on this point will be made available in due time by R. W. Johnson, secretary of the Institute, 333 North Michigan Ave., Chicago.

Mississippi Valley Highway Conference Program

THE twenty-sixth annual meeting of the Mississippi Valley Conference of State Highway Departments, in session at the Stevens Hotel, Chicago, on February 1, 2 and 3, is presenting a program of unusual thoroughness, covering all phases of highway planning and construction.

By far the heaviest part of the 3-day program falls on February 1, when separate sessions are to be held by the various groups, including (a) the administrative officers' group, (b) the construction engineers' group, (c) the maintenance, traffic and equipment engineers' group, (d) the bridge engineers' group, (e) the design engineers' group, (f) the materials and testing engineers' group, and (g) the auditors' and accountants' group.

The meeting of the construction engineers' group will hear, among other papers and discussions, the following dealing with concrete road construction:

(1) Limitations in the use of two or more sizes of coarse aggregates in concrete pavements; (2) Mixing-time specifications for 27-E mixers; (3) Double drum mixers; (4) Truck mixers, economic limits, mixing and placing; (5) Finishing operations as affecting sealing; curing time and equipment—burlap, calcium chloride, bitumen, paper; (6) Field experience with harsh mixes designed for maximum density and reduced cement content; (7) Compaction methods, rollers and vibratory screens; (8) Transverse joints in concrete pavements. (a) New developments. (b) Installation of various types—air cushion, premoulded, poured; (9) New developments in concrete paving; (10) Use of vibrating machinery in concrete structures and pavements; (11) Further experience with the use of bitumenized cement.

The maintenance, traffic and equipment engineers' group will deal with a number of subjects, of which the following are concerned with concrete roads:

(1) Methods of repairing concrete pavements; (2) Proper bitumens for use at joints and cracks; (3) Practice in placing concrete patches, high-early-strength concrete, equipment and organization; (4) Treatment of heaves and depressions; (5) Treatment of shoulders.

The bridge engineers' group will hear a paper on rigid-frame bridge construction—its use and limitations, while another of the numerous papers to be presented will deal with spans continuous over supports.

The designing engineers' group will, likewise, have discussions of a number of problems pertaining primarily to concrete roads, including:

(1) Expansion joints in concrete pavements; (2) Design for transfer of highway loads across transverse joints in concrete pavements; (3) Separation of slabs along longitudinal joints on widened pavements; (4) Use of reinforcement in concrete pavements; (5) Design of widened concrete resurfacing over old concrete pavements.

H. C. Frahm, State Highway Engineer, Bismarck, North Dakota, is president of the Mississippi Valley Conference, and M. W. Torkelson, Director of Regional Planning, Wisconsin State Highway Department, Madison, Wisconsin, is secretary.

Ready-Mixed Concrete Meeting in Cincinnati

THE National Ready-Mixed Concrete Association is holding its annual meeting in Cincinnati on January 27, at the Netherland Plaza Hotel, as this issue of CONCRETE goes to press. The date for this meeting was timed to fall on the closing day of the meetings of the three aggregates associations being held at the same hotel during the entire week of January 22 to 27.

Concrete Masonry Association to Hail Business Improvement at Toronto Convention

THE 1934 annual meeting of the National Concrete Masonry Association will be held at the Royal York Hotel, Toronto, Ontario, Canada, on February 19 and 20, in advance of the sessions of the American Concrete Institute, scheduled to be held in the same city. Indications are that the C. M. A. sessions will be well attended, for the leaders of this industry are unanimous in the belief that better times are ahead.

The code of fair competition for the industry will be one of the subjects under discussion. While the program has not been fully developed, it is known that the following subjects will be covered in detail:

(1) Address by President Benjamin Wilk, on the state of the industry.

(2) The market for concrete masonry units in 1934, including an analysis of the PWA construction program and how concrete masonry fits into that program.

(3) The architects' view of concrete masonry, including an exposition of its adaptability to architectural treatment.

(4) What the local newspaper editor wants to know about the products manufacturer and his product.

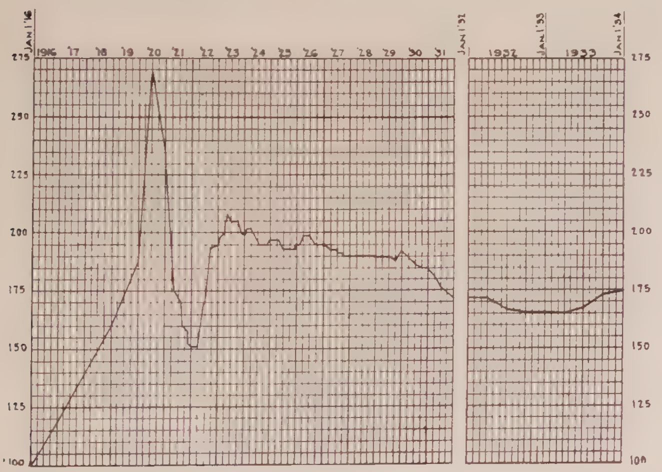
(5) The concrete house and its possibilities as the basis for future markets.

(6) The code of fair competition, and what it means to the manufacturer of concrete masonry units.

Benjamin Wilk, general manager of the Standard Building Products Company, 14250 Cloverdale Ave., Detroit, Michigan, is president of the National Concrete Masonry Association. Later information regarding the convention may be obtained either from Mr. Wilk, or from D. R. Collins, 33 West Grand Ave., Chicago.

Aberthaw Index of Cost of Building

THE up-trend in building costs which made its first appearance on July 1, 1933, has continued its course to the end of the year, according to the Aberthaw Index of cost of building. In the last quarter of the year there was a further advance of 2 points bringing the index figure to 175 for January 1, 1934. This new value indicates a cost of $1.84 per sq. ft. of floor area for the 7-story reinforced concrete industrial building used in preparing the estimate.



The last-quarter increase of 2 points arises mainly from advances in prices of certain building materials, such as sand, stone, tile and glass.

Associations Select Combination Directorship to Create Code Authority

AT a meeting for the selection of the Board of Directors of the National Concrete Masonry Association, held in Washington, D. C., on January 10, the following directors were elected: Benjamin Wilk, Detroit, Michigan; Horace W. Bush, Lyndhurst, New Jersey; George Krier, Brooklyn, New York; Dan Servey, Kansas City, Missouri; Nolan Browne, Dallas, Texas; F. R. Zaugg, Tacoma, Washington; Austin Crabbs, Davenport, Iowa; J. G. Landis, Bareville, Pennsylvania.

Benjamin Wilk of Detroit, Michigan, was elected president; and Horace W. Bush, secretary and treasurer.

The National Cinder Concrete Products Association held their meeting at the same time for the selection of their board of directors. The combination of the directorship of the two associations in accordance with their relative production was formed to create the Code Authority for the concrete masonry industry. This code authority is made up as follows: Benjamin Wilk, chairman; H. W. Bush, secretary and treasurer; Howard Brooke; Austin Crabbs; George Krier; J. G. Landis; Harry Longnecker; Dan Servey.

The secretary and treasurer of the National Concrete Masonry Association and the secretary and treasurer of the Concrete Masonry Industry, Code Authority will set up an office, probably in New York City within a short time. Temporarily, Mr. Bush can be reached at his home address, 211 Edgemont Place, Teaneck, New Jersey.

General Contractors Enthusiastic Over Construction Outlook

FORESEEING the prospect of a great concentration of actual construction work in the very near future, preparations for inducing and handling during 1934 the first rising volume of construction since 1929 constituted the principal theme for discussion at the fifteenth annual convention of the Associated General Contractors of America, in session on January 29, 30 and 31, at Washington, D. C.

With allotments under the ponderous PWA program virtually completed and reaching the contract award stage in increasingly heavy volume, construction leaders expect to see the greatest employment opportunities in years, beginning with the early spring months. Every effort to sustain this activity throughout 1934, through a revival of private construction and probably additional federal grants for state and municipal public works, will be made.

Road Builders' Convention and Exhibit Draw Large Attendance

Better Feeling in Highway Construction Industry in Marked Contrast with Year Ago—To Continue Fight Against Diversion of Highway Funds

THE thirty-first annual convention and highway exhibit of the American Road Builders' Association, held at the Stevens Hotel in Chicago during the week beginning January 22, has given the construction industry an inspiring start for 1934.

Announced objectives of the A. R. B. A. may be boiled down to the following:

(a) The continuation of an adequate highway and street program.

(b) The use of highway revenues for highway construction and maintenance.

(c) Continuation of appropriations by the federal government toward the completion of the highway system.

Modified Exhibit Pleases Delegates

The modified exhibit, laid out on a basis that eliminates the enormous expense involved in the placing and removal of heavy machinery units, is a change that was welcomed by the delegates, for it brought the exhibit and the group meetings all under the same roof.

The exhibitors, in their booths, were able to utilize portable moving picture outfits, models, samples and similar means, for the dissemination of information.

The various highway groups, as usual, held separate sessions. In addition, there were joint sessions of all groups, and a general technical session.

Placing Concrete Road Slabs in Winter

Among the various papers and reports presented, special mention should be made of the paper by H. F. Clemmer, engineer of materials, District of Columbia Division of Materials and Tests, on "Early-Strength Concrete—Effective Temperatures." The use of early-strength concrete in highway construction has special application to the winter months. That such application is practicable has been demonstrated by the Ohio State Department of Highways, as told in an illustrated article on pages 7 and 8 of the January (1934) issue of CONCRETE.

For many years highway contractors have completed grading work and bridge and culvert construction in the late fall and winter months, deferring the placing of the concrete road slab until spring. It may now be expected that the use of high-strength concrete, in order that concrete road slabs may be placed in winter months, will receive increasing attention from the industry.

In addition to the paper by H. F. Clemmer, just mentioned, others who made contributions of general or special interest to the concrete construction industry were:

(1) J. B. McCord, maintenance engineer, U. S. Bureau of Public Roads, Washington, read a paper on "Maintenance Cost Studies on Special Projects."

(2) H. G. Shirley, chairman, State Highway Commission, Richmond, Virginia, offered a paper on "A Plan of Action for the Continuance of an Adequate Highway Program."

(3) Paul N. Coates, county engineer, Ramsey County, St. Paul, Minnesota, reported on "The Selection and Supervision of CWA Projects by Counties."

(4) G. J. Kane, chief engineer of the CWA for Ohio, Columbus, Ohio, presented a paper on "Selection and Supervision of CWA Projects in Ohio."

(5) Louis E. Guyott, president of the Guyott Construction Co., New Haven, Connecticut, discussed a subject that is in the minds of all contractors in his paper on "The NRA Code and Rules and Regulations for Highway Contractors."

Referring again to the Clemmer paper on "Early-Strength Concrete," it is expected that an early issue of CONCRETE will contain an abstract of this presentation.

Aggregates Associations Meet

THE three national associations of producers of concrete aggregates—the National Sand and Gravel Association, the National Crushed Stone Association, and the National Slag Association—after having developed a single code of fair competition covering the three groups, have continued the good work of co-operation by holding simultaneous annual conventions.

The three conventions—partly in the form of joint sessions and partly separate—have just been concluded in Cincinnati, the program having extended through the entire week of January 22-27. A fourth association representing an allied group—the National Ready-Mixed Concrete Association—held its annual meeting at the same place on the concluding day of the week. All sessions convened at the Netherlands Plaza Hotel.

While various committee meetings and other business matters were disposed of on Monday afternoon and evening (January 22), the regular convention sessions did not swing into action until the morning of January 23, when separate sessions were held. After a luncheon of the three groups, a joint session was conducted in the afternoon, during which the NRA code was taken up for extended discussion.

On Wednesday, January 24, joint sessions were held in the morning and afternoon, for discussions dealing with the organization of districts and the duties of regional committees. Wednesday evening was given over to separate meetings devoted to the development of price policies and uniform cost-finding methods, hours and wages, unfair trade practices and administration of the combined code of fair competition.

The last of the joint sessions was held on Thursday morning, January 25, when further code administrative details were thrashed out. Friday was devoted to additional business meetings of the separate groups, and on Saturday, January 27, the principal event was the meeting of the producers of ready-mixed concrete.

NATIONAL RECOVERY

demands year-round concrete construction

"DO YOUR PART"

THE steady employment of men — and more men — on concrete paving keeps things moving, not only on construction work, but in the industries which produce and transport the materials required.

Most proposed or winter-suspended projects can get under way *now* (instead of April) if Calcium Chloride is used for concrete curing.

Calcium Chloride in the mix accelerates the setting of the cement so that full-strength concrete is assured at low temperatures.

Special protection for the concrete is not necessary unless temperatures are well below freezing. . . . Even then the use of Calcium Chloride reduces the time required for protection, so that cold-weather concreting is not excessively costly or troublesome.

The better the cement the more necessary is the use of Calcium Chloride — for the finer cements are more affected by changes in temperature and are particularly reactive to Calcium Chloride.

• • •

The use of Calcium Chloride in concrete is approved by the U. S. Bureau of Public Roads and the Portland Cement Association. Get the full Calcium Chloride story—write to any of the following members of the

CALCIUM CHLORIDE ASSOCIATION

THE COLUMBIA ALKALI CORPORATION
Barberton, Ohio

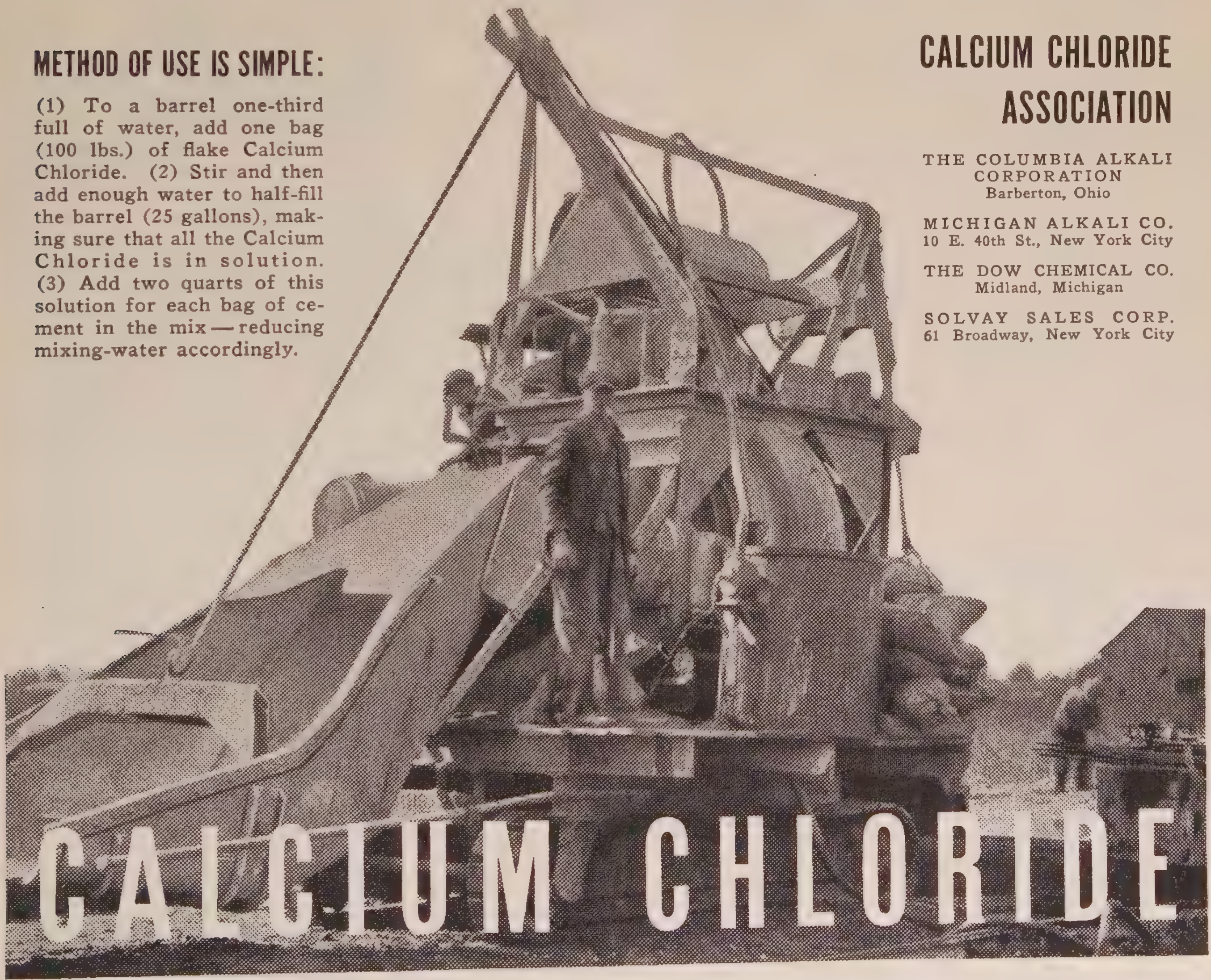
MICHIGAN ALKALI CO.
10 E. 40th St., New York City

THE DOW CHEMICAL CO.
Midland, Michigan

SOLVAY SALES CORP.
61 Broadway, New York City

METHOD OF USE IS SIMPLE:

(1) To a barrel one-third full of water, add one bag (100 lbs.) of flake Calcium Chloride. (2) Stir and then add enough water to half-fill the barrel (25 gallons), making sure that all the Calcium Chloride is in solution. (3) Add two quarts of this solution for each bag of cement in the mix — reducing mixing-water accordingly.



FOR EARLY-SPRING CURING AND HIGH-EARLY-STRENGTH CONCRETE

Series of Concrete Contractors' Meetings Sponsored by P. C. A.

Discuss Kinds of Construction Work Available and How to Go After It—Sales Manual Given to Contractors Attending Meetings

CONCRETE construction jobs—and how to get them—is the principal theme at a series of concrete contractor meetings being held in a number of cities under the sponsorship of the Portland Cement Association.

Meetings to Cover Entire Country

The intention is to cover the entire country with these meetings, the first of which was held on January 17. So far as the scheduled dates and places can be obtained at the time of going to press, advance announcements will appear in CONCRETE. Meetings were held prior to February 1 at the following locations:

Jan. 17	Joliet, Ill.
Jan. 19	Elgin, Ill.
Jan. 23	Peoria, Ill.
Jan. 23	Austin, Tex.
Jan. 26	East St. Louis, Ill.
Jan. 26	Fort Worth, Tex.
Jan. 30	Waco, Tex.

Meetings thus far scheduled for the month of February are—

Feb. 2	San Antonio, Tex.
Feb. 2	Little Rock, Ark.
Feb. 6	Memphis, Tenn.
Feb. 6	Charleston, W. Va.
Feb. 9	Louisville, Ky.
Feb. 9	Houston, Tex.
Feb. 13	Indianapolis, Ind.
Feb. 16	Fort Wayne, Ind.
Feb. 16	Detroit, Mich.

New Sales Manual for Contractors

Concrete contractors who attend these meetings are given a wealth of practical and usable ideas by men who can talk from experience. Every contractor who attends a meeting will also be given, without charge, a most effective tool for putting those ideas to work—a loose-leaf book, or sales manual, entitled "Concrete Jobs: How to Get Them."

An enormous amount of thought and labor must have been expended in the preparation of this manual. It outlines the markets for the concrete contractor, pointing out dozens of types of construction work available to the hustler who goes after them in the right way.

It sets forth sales plans based on the actual experiences of hundreds of successful contractors during 1933.

It tells the contractor how to approach his prospects and how to plan his own sales efforts.

It presents examples of newspaper advertisements that built business for concrete contractors in 1933.

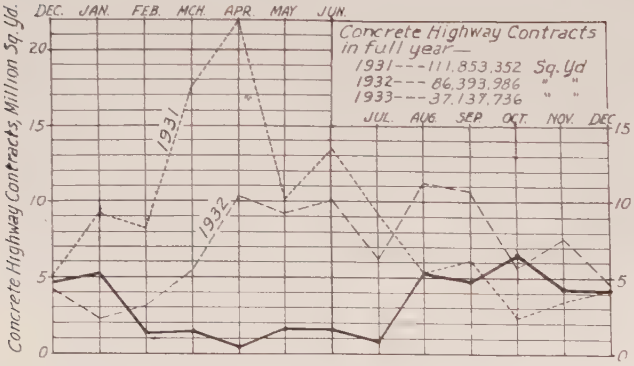
And aside from all this, it contains plans and detailed drawings of new types of construction work.

Badminton Wins Popularity

Among the detailed drawings just mentioned is a set of working plans for a concrete badminton court. Badminton, played on a single court 44 by 17 ft., or on a double court 44 by 20 ft., requires considerably less space than tennis, making it more practicable for the average residence lot. The game is something new and novel, it is played by people of all ages, and it is now enjoying a rising tide of popularity. In consequence, the construction of concrete badminton courts should be pushed while this popularity is on the up-trend.

Concrete badminton court. This new game has gained wave of popularity

Acknowledgment: G. F. Steigerwalt, J. W. Lewis and E. W. Dienhart, of the Portland Cement Association, are devoting the greater part of their time to these contractor meetings. Contractors wishing to insure receipt of advance notice of meetings should write to the Portland Cement Association at 33 W. Grand Ave., Chicago.



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1933 Concrete Paving Contracts Total 45 Million Yards

CONCRETE paving awards, including roads, streets and alleys, reached a total of 45,128,441 sq. yd. in 1933. Of this total, 37,137,736 sq. yd. represent contracts for concrete road construction, the remaining yardage representing streets and alleys.

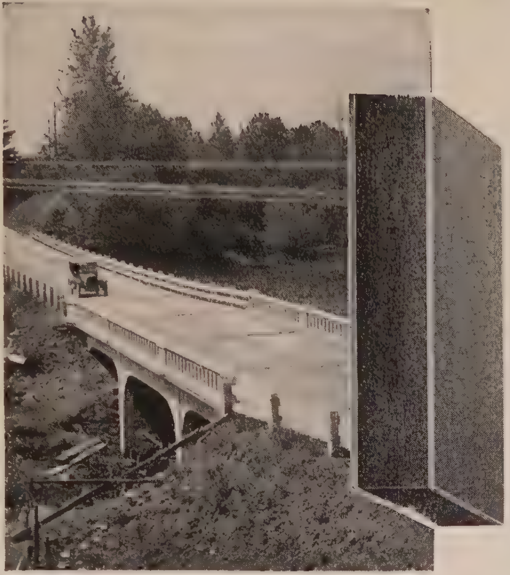
The month of December contributed 4,107,468 sq. yd. of concrete roads, and 1,810,973 sq. yd. of concrete streets and alleys, according to reports received and compiled by the highways bureau of the Portland Cement Association. December contracts for all concrete paving exceeded November by nearly 400,000 sq. yd.

SERVICISED

EXPANSION JOINTS

Sponge Rubber
Cork
Felt Sided
Plain Composition

SERVICISED Expansion Joints, whether sponge rubber, cork, felt sided, or plain composition, excel! SERVICISED Expansion Joints have given service over a period of twelve years, and are found in State highway work in every State in the Union which has used Expansion Joint within this period. You will not be doing justice to your organization without securing prices and learning about these products.



ASPHALT PLANKING

Standard — Sementread
Rock Surfaced

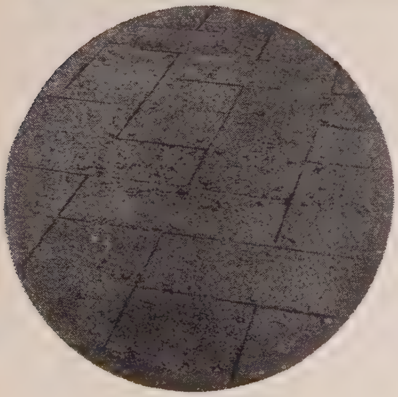
BRIDGE PLANKING PROTECTION COURSE

SERVICISED Bridge Planking has now been in use for more than seven years! No SERVICISED Planking has ever been replaced where it was recommended for the job. It is made in Standard, Sementread and Rock Surfaced styles and is in use on the main Chicago bridges where probably more traffic is encountered than on any other thoroughfare.

SEMENTREAD

SEMENTREAD is a new skid-proof planking—one which can be guaranteed skid-proof—when laid horizontal to the traffic it promptly stops the forward motion of the car, and when laid vertical to the traffic it stops the side skid as well as forward skidding. SEMENTREAD comprises a cement rib keyed in the asphalt plank surface, which adds rigidity to the surface also making it skid-proof. This material is especially adapted on city bridges and viaducts where wet days are a menace to traffic and where short skids are dangerous and cause accidents. **Be sure to learn about this product before laying another foot of planking!**

Guaranteed Skid-Proof



Rock Surfaced Planking

ROCK SURFACED planking comprises SERVICISED asphalt planking having imbedded in its surface particles of rock. We do not believe that this is in any measure as skid-proof as SEMENTREAD. It, however, prevents skidding to a greater extent than the plain surfaced asphalt planking.

CENTER ROAD MARKINGS

SEMENTREAD planking in six or eight inch widths is highly adapted for road marking purposes having alternate black and white or black and yellow lines—the lines consisting of Portland cement.

Write today for full particulars on SERVICISED Products

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6051 West 65th Street CHICAGO

Sales Rights Are Available

HOW TO DO IT

◆ **Questions and Answers** ◆
Consultation and Comment

A department devoted to the solution of problems encountered in concrete work. Readers are welcome to add to or improve upon the suggestions printed and to submit their views for possible publication.

Cleaning Hardened Concrete from Metal Forms

We rent out steel forms for concrete construction. Often the forms are returned to us in rather bad condition, with hardened lumps and pats of concrete adhering to the metal. We have had to remove this with cold-chisels, files, scrapers and wire brushes—an expensive and tedious process.

Is it possible to soften and remove this concrete with some chemical that will not damage the metal of the forms?—C. C. F.

The use of a strong alkaline solution, such as lye, has been recommended for this purpose. It is true that alkaline waters in soil act on concrete slowly; but the solutions occurring in nature are relatively very weak.

A very strong solution of lye, on the other hand, should soften concrete in a short time, though it will not damage the metal. It is suggested that you make a few experiments with pats of concrete that have hardened on small pieces of metal of the kind used in the fabrication of the forms. By immersing the samples in a bath of the strongest possible solution of lye, for varying periods of time, the practicability of this method in your particular case may be determined.

●

Glossy Finish on Concrete Cast Stone and Tile

We have an inquiry from a correspondent asking for information on methods for producing a glossy finish on concrete cast stone and ornamental tile without resorting to mechanical polishing. Can you supply this information?—W. M. B., Seneca Falls, New York.

Apparently no method is available in this country that is fully successful in producing, automatically, a permanent glossy finish capable of standing up under outside weather exposure. Mechanical polishing seems to produce the surest results, thus far.

Methods may be employed, however, in casting the products so that a comparatively small amount of mechanical polishing will be required. For instance, if the exposed surfaces are flat, the molds may be lined with sheets of plate glass. If the surfaces are curved, the molds may be coated with bath-tub enamel. The mixture for the finish coating is then applied to the surface of the mold in the usual way, and the body concrete is added.

In this manner a surface may be obtained that is smooth and fairly glossy; but the glossy finish may be greatly increased in brilliance if the cast is allowed to harden for about eight days, and is then rubbed or polished with a piece of felt, dampened with oxalic acid. The effect thus produced is that of polished stone.

This method is described in detail in a book entitled *Molding and Curing Ornamental Concrete*, by A. A. Houghton, obtainable from the Concrete Publishing Company, 400 W. Madison St., Chicago, at 75 cents a copy.

It is suggested also that your correspondent watch the items appearing in CONCRETE under the heading "From the Patent Office," through which he may learn of patented processes intended to produce glossy finishes. Copies of patents can be obtained direct from the United States Patent Office, Washington, D. C., at 10 cents each.

●

Feret on Nature of Puzzolanic Action

In your December (1933) issue, page 19, reference is made to a reprint of a series of articles by R. Feret, on the nature and progress of puzzolanic action. Is this paper available in the English language; and if so, where may copies be obtained?—T. C. F., Seattle, Wash.

So far as we know, this paper is available only in the French language, under the heading "Recherches sur la Nature et la Progression de l'Action Pouzzolanique." Copies can be obtained by addressing the magazine *Revue des Materiaux de Construction*, 148 Boulevard de Magenta, Paris, France.

An article by Dr. E. W. Lazell, appearing on page 30 of the April (1933) issue of the *Cement Mill Edition* of CONCRETE under the heading "Puzzolan Admixture to Cement Aids Resistance of Concrete," contributes further to this subject.

●

Design of Circular Concrete Tanks

I am designing several circular reinforced concrete bins or silos for the storage of cement. Can you refer me to reliable design formulas that are applicable to cement storage?—C. L. F., San Francisco, Calif.

Complete formulas and design constants applicable to various materials (including cement) are given in an article by W. W. Hay, in the June (1928) issue of CONCRETE, pages 43-44.

A large chart prepared by E. Cowan, for the design of circular reinforced concrete tanks, appears on page 16 of the November (1933) issue of CONCRETE. While the Cowan chart supplies design constants for wheat alone, designers can readily construct similar charts for other granular or pulverized materials.

●

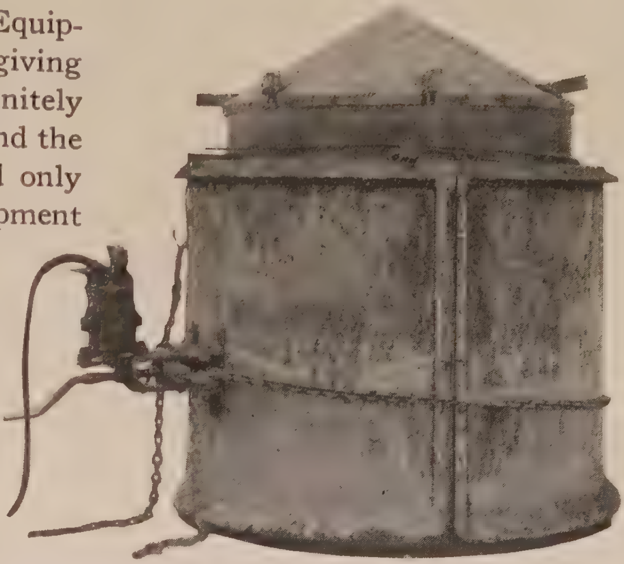
Commercial Sources of Copper Slag

We contemplate doing some experimenting with copper slag as an aggregate in the production of concrete cast stone. Is this material commercially available?—D. J. M., Reading, Penna.

Copper slag prepared as concrete aggregate may be obtained in commercial quantities in eastern Tennessee. The address of the producer is being forwarded to you.

VIBRO-CAST CONCRETE PIPE

Manufacturers utilizing Vibro-Cast Equipment in producing concrete pipe are giving their customers the benefit of a definitely superior product in strength-density and the other desirable qualities accomplished only with high frequency vibratory equipment properly designed and applied.

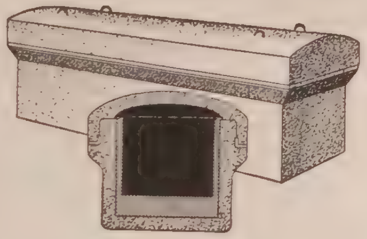


INTERNAL AND EXTERNAL
VIBRATORS
FOR ALL REQUIREMENTS

ELECTRIC TAMPER & EQUIPMENT COMPANY
Ludington, Michigan

PIONEERS IN DEVELOPING VIBRATORY EQUIPMENT FOR CONCRETE PLACEMENT

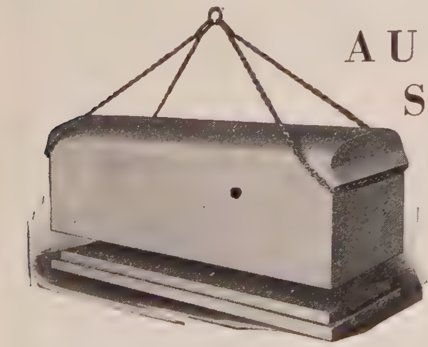
Vaults Pay
STEADY
Profits



One half to four fifths of burials are in vaults. Eleven people out of every thousand die yearly. How many thousand population has your trade territory? Find out, multiply by eleven, divide by two, and you have a conservative estimate of the vault business you might be getting. Let's say your county has sixty thousand people. Three hundred and thirty vaults, at least, will be bought in the next twelve months. Will you collect the profits on them?

Our FREE book tells how much this business is worth to you. Send for it. Collect the STEADY income; the GOOD income that is certainly awaiting you. The investment is small. The equipment is simple. The income is both plentiful and continuous. *Write for FREE book NOW.*

THE AUTOMATIC SEALING VAULT CO.
234 Riverside Drive **Peru, Indiana**



AUTOMATIC
SEAL AND
INVERTED
AIR SEAL
VAULTS

LOOK the 10S SPEED KING

Build Your Bridges with this
END DISCHARGE 2-BAGGER!

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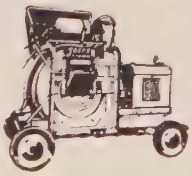

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A. R. E. A. to Discuss Concrete

THE forthcoming annual meeting of the American Railway Engineering Association, to be held at the Palmer House, in Chicago, on March 13 and 14, will hear and discuss a number of reports dealing with the production of quality concrete and with the design and construction of concrete structures. Following are some of the subjects to be covered:

(1) Report on developments in the art of making concrete, including vibration and water-segregation.

(2) Tentative specifications for the design and construction of reinforced concrete arches.

(3) Standard plans for reinforced concrete trestles.

(4) Report on details of expansion joints in structures.

(5) Tentative specifications for concrete for tunnel linings.

(6) Specifications for design of foundations.

(7) Determination of the bearing power of soil.

The head office of the American Railway Engineering Association is at 59 East Van Buren St., Chicago. E. H. Fritch is secretary.

Committee on Dudley Medal Appointed

The Executive Committee of the *American Society for Testing Materials* has appointed the following Committee on Award of the Charles B. Dudley Medal:

F. E. Schmitt, Chairman, Editor, *Engineering News Record;* H. F. Clemmer, Engineer of Tests, Dept. of Highways, District of Columbia; C. H. Mathewson, Professor of Metallurgy, Sheffield Scientific School, Yale University.

This committee will review the eligible technical papers presented at the 1933 annual meeting in Chicago and will select that paper of oustanding merit which constitutes an original contribution on research in engineering materials. The Dudley Medal was established in 1925 by voluntary subscriptions from the members as a means of stimulating research, recognizing outstanding contributions to the *Proceedings* and at the same time commemorating the name of its first president.

A. S. T. M. Calendar

THE annual meeting of the American Society for Testing Materials will be held June 25 to 29 at Chalfonte-Haddon Hall, Atlantic City, New Jersey.

1934 Group Meetings of A. S. T. M. Committees are scheduled for March 5 to 9, inclusive at the Wardman Park Hotel, Washington, D. C.

The 1934 A. S. T. M. Regional Meeting will be held on March 7 at the Wardman Park Hotel, Washington, D. C.

The technical feature of the regional meeting will be a symposium on outdoor weathering of metals and metallic coatings, sponsored jointly by Committees A-5 on corrosion of iron and steel and B-3 on corrosion of non-ferrous metals and alloys.

A statement listing the papers and giving other details of this meeting may be had by writing the Society at 260 South Broad Street, Philadelphia, Pennsylvania.

Propose Reinforced Concrete Tower 2,300 Ft. High

A reinforced concrete tower 700 meters (about 2,300 ft.) in height is proposed for the Universal Exposition to be held in Paris, France, in 1937.

The project has been developed through its preliminary stages by the well-known French engineer Freyssenet, working in collaboration with the French architectural firm of Fers, Hugues & Venzo. Freyssenet is the designer of the reinforced concrete bridge at Brest, France, which has arches exceeding 600 ft. in span.

The proposed tower is to have a spiral roadway around its exterior, so that automobiles may be driven to the top. At the top of the tower provision is to be made for a huge restaurant, a hotel, and garage space for 400 automobiles. A beacon light for air transportation and a meteorogical station are other features to be provided.

Freyssenet estimates the cost of the tower at 50 million francs, much less than the cost of a steel tower of equal height.

The Leipzig Spring Fair 1934

More than 7,000 exhibits, an increase of 15 per cent over last year, will be shown at the next Leipzig Fair, indicating a vigorous upturn in world trade conditions. It is already assured that 22 countries will send exhibits, and buyers will be assembled from 70 countries, all of which indicates that the fair maintains its centuries-old tradition of international commerce. The fair will be held from March 4 to 11, inclusive.

For many years the Leipzig Trade Fair has been considered an accurate barometer of world trade. It assembles the newest products from all parts of the world and is the meeting place of more than 150,000 business men.

From the Patent Office

By J. KAPLAN
Patent Attorney, Washington, D. C.

Concrete floor forms: Henry W. Roos, Cincinnati, Ohio. U. S. Pat. 1,929,287, Oct. 3, 1933.—These metal forms comprise two parts adjustable in relation to each other, brackets arranged in each corner to permit mounting of the forms on supporting shores, and means for securing the forms in adjusted position. Convenient assembly and removal, and low labor costs, are claimed by the inventor. See also U. S. Pat. 1,929,288, Oct. 3, 1933.

●

Concrete mixer: Adolph W. Rybeck, Milwaukee, Wisconsin. U. S. Pat. 1,927,447, Sept. 19, 1933.—Features of this mixer are a water metering and supply device, comprising a water-storage receptacle, a tubular housing member having one end bored to register with an opening in the water-storage receptacle, and other fittings designed to control the quantity of mixing water.

●

Cement lath: Anthony J. Varden, St. Louis, Missouri. U. S. Pat. 1,930,024, Oct. 10, 1933.—The lath is made of a solidified plastic material having grooves in the outer side over the full width of the lath. Fasteners may be extended through the lath through spaced openings, in combination with a series of partly embedded wires.

●

Concrete pile: Lochiel M. King, Alameda, California. U. S. Pat. 1,929,280, Oct. 3, 1933.—The invention consists of a composite pile comprising a column of reinforced concrete and a metal sleeve and cutting edge cast into the column at the lower end.

BOOKS On Concrete

The books listed below have been carefully selected by our editorial staff as useful to those engaged in making concrete in all its various forms. Prices are cash in advance and include postage.

DESIGN AND CONSTRUCTION OF FORM WORK FOR CONCRETE STRUCTURES. By A. E. Wynn. 312 pages. 219 ills., 12 folded inserts and 11 design tables. Cloth bound, stamped title in gold. **Price $6.00**

"Wynn's Book" is a phrase commonly known to engineers, designers, and foremen, and is heard wherever concrete construction is under way. This book covers every phase of forms for concrete construction, and is fully and completely supplemented with many significant illustrations, tables and drawings and printed on a superior grade of enameled paper.

CONCRETE CONSTRUCTION MADE EASY. By Leslie Turner and Albert Lakeman. 113 pages, 65 illustrations, 16 tables. Cloth bound. **Price $2.00**

A practical book that solves problems in the design and erection of any type of concrete structure. Full designs with tables and all necessary information for building of foundations, walls, columns, floors, roofs, staircases, beams, water tanks, retaining walls, lintels, formwork, saw-tooth roofs, etc. A mine of information to the novice and a fruitful source of advice for the experienced. Written clearly and plainly.

MANUFACTURE AND USES OF CONCRETE PRODUCTS AND CAST STONE. By H. L. Childe. 354 pages. 265 illustrations. Color plates. Photographs. Completely rewritten and enlarged. **Price $3.00**

Deals with problems of how to: use dry mixes for architectural concrete; minimize crazing and efflorescence; design all kinds of molds; select materials; grade and proportion aggregates, regulate mixing, and govern curing; use color in concrete; manufacture columns, cornice posts, curb, blocks and slabs, brick, roofing tile, steps, sills, lintels and edgings, balustrades, sundials, bird-baths, lettered panels, ornamental work, etc. This new 1930 edition simplifies every phase of manufacture of concrete products and cast stone of every description for every purpose.

BASIC PRINCIPLES OF CONCRETE MAKING. By Franklin R. McMillan, Director of Research, Portland Cement Association.

The author has culled the essentials out of a mass of scientific data on this subject and presents them with force and directness in this book. He shows the effects of quality of material, of proportioning, mixing, working and curing on the finished concrete.

The importance of variable mixes; tests for permeability; how to obtain strength, durability and watertightness; effective ratios; importance of proper construction methods—these and many other vital topics are discussed fully and authoritatively.

The book represents not only extensive accumulated knowledge, but also wide practical experience in the field and laboratory. It is an enlargement and revision of a series of notable articles on concrete mixing by Mr. McMillan published in 1929.

Ninety-nine pages, 6x9¼, 32 illustrations and tables. Postpaid. **Price $2.00**

CONCRETE MONUMENTS, MAUSOLEUMS AND BURIAL VAULTS. By A. A. Houghton. 65 pages, illustrated. Paper bound. **Price $.75**

The molding of concrete monuments to imitate the most expensive cut stone is explained in this treatise, with working drawings of easily built molds. Cutting inscriptions and designs is also fully treated.

***MOLDS FOR CAST STONE AND CONCRETE.** By F. Burren and G. R. Gregory. Heavy board cover, 79 pages, 11 by 7¾ in.; 44 full page illustrations. **Price $1.25**

Detailed working drawings for the practical mold maker, covering a wide range of concrete and cast stone products. Drawings supply the necessary information, and brief descriptions are given in each case.

A lot of good information, not only for cast stone manufacturers, but for makers of special products made of ordinary concrete, such as fence posts, chimney caps and pots, well linings, laundry tubs, etc.

***GENERAL ENGINEERING HANDBOOK.** By Charles Edward O'Rourke and 29 associates. Flexible cover; 921 pages, 5 by 8 in., numerous tables, diagrams and illustrations. **Price $4.00**

This book assembles a great amount of fundamental engineering data in usable form. 31 separate sections deal with as many specific branches of engineering.

Of particular interest to engineers who specialize in the use of concrete as a structural material are sections devoted to "Highway," by Thomas R. Agg; "Reinforced Concrete Structures," and "Stresses in Framed Structures," by Charles Edward O'Rourke; "Engineering Materials," by Herbert H. Scofield; "Foundations," by Roland P. Davis; and "Mechanics," by Alfred P. Poorman.

REINFORCED CONCRETE CONSTRUCTION. By George A. Hool, Professor of Structural Engineering, University of Wisconsin. University of Wisconsin Extension Series.

Vol. I—Fundamental Principles. Third Edition. 380 pages, 6x9, 139 illustrations, 18 tables, 28 diagrams **$3.50**

Vol. II—Retaining Walls and Buildings. Second Edition. 700 pages, 6x9, illustrated **$6.00**

Vol. III—Bridges and Culverts. 688 pages, 6x9, over 600 illustrations, 41 plates **$6.00**

***CONCRETE ENGINEERS MANUAL.** By Samuel Baker and A. DeGroot. Cloth, 401 pages, 5 by 7¾ in., numerous drawings, charts and tables. **Price $3.00**

This volume is intended as a textbook for students of concrete engineering, and as a reference book for designers, foremen, inspectors, and others involved in the design of concrete structures and in the making and placing of concrete.

The book contains a complete description of the modern methods of proportioning concrete mixtures, mixing and placing concrete and steel, and providing waterproofing. Mathematical tables and the fundamental principles of mathematics and mechanics of materials, as applied to reinforced concrete designs, are included.

Among other subjects treated in individual chapters are form work, foundations, design of retaining walls, and estimating concrete work.

CEMENT CHEMISTRY IN THEORY AND PRACTICE. By Prof. Dr. Hans Kuhl, Director of the Institute for Cement Research, Berlin. Translated into English by J. W. Christelow, B.Sc. 64 pages, 6 by 9, cloth cover. Illustrated with a number of halftones and diagrams. **Price $2.50**

An authoritative book on the chemistry of cement, a translation of a series of lectures delivered by Dr. Kuhl in Moscow, at the special request of the Soviet government. The author presents the most up-to-date knowledge of the subject in simple language. The translator is one who knows his subject very thoroughly. The result is a concise record of modern research on the manufacture and setting of cement.

CONTENTS

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2. The Theory of Cement Burning.
3. The Constitution of Portland Cement Clinker.
4. The Problem of Hardening and Its Significance in Cement Research.
5. The Chemistry of High-Strength Cements.
6. The Technical Aspect of High-Strength Cements.

PRE-CAST CONCRETE FACTORY OPERATION. By H. L. Childe, Editor, "Concrete Building and Concrete Products" (England). 190 pages, 5½x9, illustrations and layouts. **Price $2.00**

Complete descriptions of the plant layouts, equipment, methods, and processes of 20 English manufacturers, large and small. Includes the whole range of pre-cast units from the largest cast stone and roofing tile and plain block plants to the small producers of miscellaneous products.

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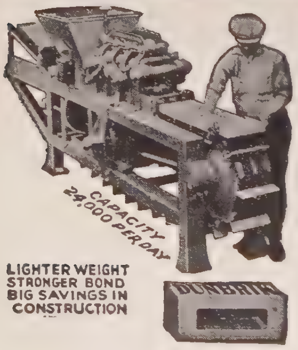
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O. L. Chapman at A. R. B. A. Banquet

WHEN Oscar L. Chapman, assistant secretary of the interior and executive secretary of the special board for public works, arrived on the Capitol limited from Washington to address the annual banquet of the American Road Builders Association on January 23, he was greeted at the station by a committee representing the association.

In the welcoming committee were Capt. H. C. Whitehurst, Washington, D. C., president of the association; J. H. MacDonald, New Haven, Conn., treasurer and past president; C. M. Upham, Washington, D. C., secretary; H. G. Sours, Akron, O.; C. H. Grubb, Washington, D. C.; Robt. B. Brooks, St. Louis, Mo.; B. F. Affleck, president of the Universal Atlas Cement Company; A. C. Cronkrite and M. A. Berns of Chicago.

Front row, left to right: H. G. Sours, R. B. Brooks, J. H. MacDonald, O. L. Chapman, Capt. H. C. Whitehurst, C. M. Upham, and C. H. Grubb. Rear row: M. A. Berns, A. C. Cronkite, Stanley Nelson, Dr. Lund and B. F. Affleck

W. C. P. M. A. Convention

THE 1934 convention of the Wisconsin Concrete Products Manufacturers' Association will be held on February 8 and 9 in the Gold Room of the Wisconsin Hotel, Milwaukee, Wisconsin.

The main topic to be discussed at this convention is the Wisconsin state code.

There is to be a banquet on Thursday evening February 8 in the Badger Room of the Wisconsin Hotel with speakers and entertainment by a popular German band from Milwaukee.

✦ PERSONALS ✦

Frederick M. Feiker has been appointed executive secretary of American Engineering Council, with headquarters at 744 Jackson Place, Washington, D. C., a position for thirteen years held by Lawrence W. Wallace, who has resigned to become vice-president of the W. S. Lee Engineering Corporation.

F. E. Turneaure, dean of the college of mechanics and engineering, University of Wisconsin, and author of well-known textbooks on reinforced concrete design, was awarded honorary membership in the American Society of Civil Engineers, on January 17, at the eightieth annual meeting of that society.

Coming Conventions

February 1-3—Mississippi Valley Conference of State Highway Departments. 26th Annual, Stevens Hotel, Chicago. M. W. Torkelson, Madison, Wisconsin, Secretary.

February 8-9—The Engineering Institute of Canada. 48th Annual. Windsor Hotel, Montreal, Quebec, Canada. R. J. Durley, Gen. Secy., 2050 Mansfield St., Montreal.

February 8-9—Wisconsin Concrete Products Manufacturers' Association, Inc. Convention. Gold Room, Wisconsin Hotel. L. E. Schwalbe, Secretary, Wauwatosa, Wisconsin.

February 19-20—National Concrete Masonry Association. Annual. Royal York Hotel, Toronto, Canada. D. R. Collins, Asst. Secy., 33 W. Grand Ave., Chicago.

February 20-22—American Concrete Institute, thirtieth annual convention. Royal York Hotel, Toronto, Canada.

February 21-22—The Missouri Highway Engineers' Association. Kansas City, Mo.

February 23-24—American Concrete Pipe Association. Annual Meeting, Edgewater Beach Hotel, Chicago. M. W. Loving, Secy., 33 West Grand Avenue, Chicago, Ill.

March 4-11—Leipzig Trade Fair, Leipzig, Germany. 1934 Spring Fair with Exhibits. Leipzig Trade Fair, Inc., 10 E. 40th St., New York City.

March 5-9—American Society for Testing Materials. 1934 Group Meetings of Committees. Wardman Park, Hotel, Washington, D. C.

March 7—American Society for Testing Materials. 1934 Regional Meeting. Wardman Park Hotel, Washington, D. C.

March 13-14—American Railway Engineering Association. Annual Meeting, Palmer House, Chicago. E. H. Fritch, Secy., 59 E. Van Buren St., Chicago, Ill.

March 15-16—Concrete Reinforcing Steel Institute. Annual Meeting, Chicago. R. W. Johnson, Secy., 333 North Michigan Ave., Chicago, Ill.

June 25-29—American Society for Testing Materials. Annual. Chalfonte-Haddon Hall, Atlantic City, N. J.

OBITUARY

A. O. Elzner, prominent architect and pioneer in the use of concrete in building construction, died at his home, 227 Greendale Avenue, Clifton, Ohio, on November 26, after an illness of more than a year. He was 71 years old.

Several decades ago Mr. Elzner upset some of the orthodox beliefs of the architectural world of the day in designing the Ingalls Buildings, one of the first skyscrapers in which reinforced concrete was used as the structural frame. Many prophecies were made at the time that a concrete building could not be made durable, and Mr. Elzner was regarded then as a fanciful dreamer for working out building construction with a material that later was to be used the world over.

Clifford F. Messinger, president of Chain Belt Company, died suddenly on December 12, at his home in Milwaukee. Graduated from Sheffield Scientific School of Yale University in 1911, Mr. Messinger moved to Milwaukee and entered the service of Chain Belt Company in the same year. In 1913, he became advertising manager and then successively sales manager, general manager, vice-president and president.

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THE author has culled the essentials out of a mass of scientific data on this subject and presents them with force and directness in this book. He shows the effects of quality of material, of proportioning, mixing, working and curing on the finished concrete.

The importance of variable mixes; tests for permeability; how to obtain strength, durability and watertightness; effective ratios; importance of proper construction methods—these and many other vital topics are discussed fully and authoritatively.

The book represents not only extensive accumulated knowledge, but also wide practical experience in the field and laboratory. It is an enlargement and revision of a series of notable articles on concrete mixing by Mr. McMillan published in 1929.

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ORGANIZATIONS

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AMERICAN CONCRETE INSTITUTE; Harvey Whipple, Secretary, 7400 Second Blvd., Detroit, Mich. Thirtieth annual convention, February 20-22, Royal York Hotel, Toronto, Canada.

AMERICAN CONCRETE PIPE ASSOCIATION; M. W. Loving, Secretary, 33 West Grand Ave., Chicago.

AMERICAN RAILWAY ENGINEERING ASSOCIATION; E. H. Fritch, Secretary, 59 East Van Buren St., Chicago, Ill.

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ASSOCIATED GENERAL CONTRACTORS OF AMERICA; E. J. Harding, Managing Director, 222 Munsey Bldg., Washington, D. C.

BUILDING OFFICIALS CONFERENCE OF AMERICA; Wm. F. Hurd, Secretary, Room 203, City Hall, Indianapolis, Ind.

CAST STONE INSTITUTE; L. A. Falco, Secretary, Chapel St. and Blatchley Ave., New Haven, Conn.

CEMENT INSTITUTE; H. C. Lundborg, General Manager, 11 East 44th St., New York City.

CONCRETE REINFORCING STEEL INSTITUTE; R. W. Johnson, Secretary, 333 North Michigan Ave., Chicago, Ill.

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NATIONAL FIRE PROTECTION ASSOCIATION; Franklin H. Wentworth, Secretary, 40 Central St., Boston, Mass.

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RAIL STEEL BAR ASSOCIATION; H. P. Bigler, Engineering Secretary; Builders' Bldg., 228 N. La Salle St., Chicago, Ill.

WIRE REINFORCEMENT INSTITUTE; R. D. Bradbury, Director, National Press Bldg., Washington, D. C.

WISCONSIN CONCRETE PRODUCTS MANUFACTURERS' ASSOCIATION, INC.; L. E. Schwalbe, Secretary, Wauwatosa, Wis.

New Books and Pamphlets

A. S. T. M. Tentative Standards

Book of A. S. T. M. Tentative Standards, 1933 Edition, published by the American Society for Testing Materials, 260 South Broad St., Philadelphia. Cloth or paper binding, 1,136 pages. Price $8.00 for cloth, or $7.00 for paper binding.

This annual publication of the American Society for Testing Materials contains all tentative specifications, methods of test and definitions of terms issued by the Society, covering engineering materials and the allied testing field. Although in the trial stage of standardization procedure, these tentative standards, embodying the latest convictions and practices, find important application and are widely used in industry.

The 1933 edition of this book contains 223 tentative standards. Of these 47 are published for the first time, while 41 were revised in 1933 and are given in their latest approved form. No less than 45 of the tentative standards deal with cement, lime, gypsum, refractories, concrete, or masonry materials.

Among the new tentative standards are those covering ready-mixed concrete and those on paving concrete. Others establish test methods for determining absorption by concrete aggregates.

Pavements Resurfaced with Concrete

Pavements Resurfaced with Concrete is the title of a new 20-page booklet issued by the Portland Cement Association, 33 W. Grand Ave., Chicago.

The booklet is well illustrated with halftones and line drawings, and it includes tables giving recommended thicknesses and character of design for varying conditions of traffic and support. The recommendations made are based on an extensive survey of concrete resurfacing projects all over the United States.

Highway and city engineers, as well as other highway and city officials, should have this booklet at hand. Free copies are available to those requesting them.

Fireproof Homes—How Built

It Pays to Own a Fireproof Home—Here's How It's Built with Concrete is the title of a new illustrated booklet, 20 pages, 8½ by 11 in., published by the Portland Cement Association, Chicago.

Concrete products manufacturers, concrete contractors, and the cement industry in general, will find in this booklet a definite aid in popularizing the concrete home. It tells just what a fireproof concrete home consists of, and how it is built. Copies may be obtained from the publisher, on request.

A. S. T. M. Standards Index

1933 Index to A. S. T. M. Standards and Tentative Standards, a book of 124 pages with heavy paper cover, has been issued by the American Society for Testing Materials.

The book lists a total of 689 standards and tentative standards, and will be helpful to materials engineers and specification writers in determining whether any specific material or subject is covered by A. S. T. M. specifications. Copies may be obtained without charge by addressing the A. S. T. M. at 260 South Broad St., Philadelphia.

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FORM WORK
By A. E. WYNN

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THE need that has for many years existed for one comprehensive text covering the entire subject of concrete form work from the viewpoints of designer, engineer, foreman, and workman has at last been met by this painstaking and complete book. It is written by Mr. A. E. Wynn of Matthys and Co., Binghamton, N. Y. Probably no one could be found who is a better authority on all phases of the subject, or who would devote greater care to the writing of such a book.

No expense has been spared to make this book absolutely thorough. It contains 320 pages, 219 illustrations, 12 folded inserts, and 11 design tables. It is strongly bound in cloth covers with title stamped in gold.

Although this book is issued by an English publisher, it is possible for American contractors and engineers to secure it without any formalities or undue expense. We have purchased an ample stock of the book, and will be able to make immediate shipment of it to any part of the United States upon payment of the price of

$6 Post and Duty Paid

Address all orders to—

BOOK DEPT. OF CONCRETE
400 W. Madison Street Chicago, Illinois

EQUIPMENT AND MATERIALS

A New Water Paint

An entirely new type of water paint in colors has been developed by Master Builders Research Laboratories. It is known as "Colored Masterseal" and is formulated on a unique principle which uses a bituminous emulsion with colors as a base.

This product may be applied on damp or dry masonry surfaces of every description, including fresh lime plaster, Keene's cement, green concrete, brick, stone and tile—either by brush or spraying. Once applied to the surface, it is said to harden quickly and to be unaffected by moisture, efflorescence or similar ills which affect the appearance of moist plaster, masonry or concrete surfaces. It will not discolor or rub off, the makers say, and may be washed, as desired, without affecting the durability or color of the product.

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A New Mixer

The 10-S Dandie is a new 2-bag mixer, made by the Koehring Company of Milwaukee, incorporating features, they say, never before offered to the contractor. It is said to be staunchly built, light in weight, and speedy in operation.

The mixer is equipped with LeRoi multiple "V" belt drive engine and a vertical syphon type water measuring tank for accurate and fast water supply.

10-S Dandie 2-bag mixer

One-man end control permits the operator to see both sides of the mixer. Charging, mixing, or discharging are efficiently handled from the drum end of the machine.

●

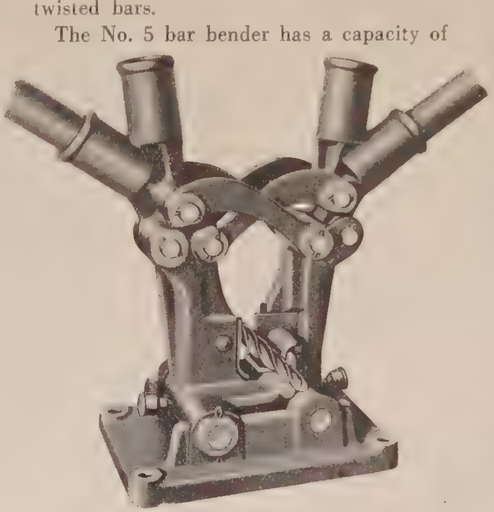
Jack Franklin, who has represented the Besser Manufacturing Company in Milwaukee for many years, and has taken an active part in the affairs of the Concrete Masonry Association and the Wisconsin Concrete Products Association, has moved to Newark, N. J., where he will continue to represent the Besser interests as Eastern sales manager.

Bar Benders and Cutters

Bar cutters and benders are new contractors' equipment manufactured by the C. H. & E. Manufacturing Co., Inc., Milwaukee, Wisconsin.

Both are made in two sizes. The No. 1 cutter has a capacity, they claim, of ¼ to ¾ round or twisted bars; the No. 2-A shears ¾-in. to 1¼-in. round, up to 1⅛-in. twisted bars.

The No. 5 bar bender has a capacity of 1-in. twisted or 1¼-in. round bars; the No. 6-A, a maximum capacity of 1¼-in. twisted, or 1½-in. round bars.



No. 2-A bar cutter

One man can easily operate either of the small size tools, the manufacturers say.

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Cork Expansion Joint

Because of its easy compressibility and its exceptional recovery after extended periods of compression, Johns-Manville Cork expansion joint provides a permanent means of compensating for the unavoidable expansion and contraction of pavement and structures under varying temperature and moisture conditions, they say. J-M cork expansion joint expands and contracts as required to fill the joint completely and is said to require no maintenance.

This joint is said to recover thickness as the pavement contracts

General Motors Sales Convention

Zone managers and distributors from all parts of the United States assembled in Detroit on January 22 for a three-day conference with Vice-President and Director of Sales, J. P. Little of the *General Motors Truck Company*. A complete sales program for 1934 was outlined and various phases of sales promotion activity and stimulation were presented by department heads. President Paul W. Seiler welcomed the visitors at the factory in Pontiac.

Government aid and support in the direction of many building and construction projects has opened up a vast new field for heavy duty truck application, and the company announced a number of innovations, improvements and refinements in their line.

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Helpful Building Facts

Two new booklets, "*For Damage-Proof Construction*" and "*For Smooth, Finless Concrete*," have just been issued by the Douglas Fir Plywood Association, Seattle, Washington.

The first tells how to use the various thicknesses of Douglas Fir Plywood for walls and ceilings, sheathing, subflooring, built-ins, etc. There are numerous stimulating photographs, as well as construction details, finishing instructions and test data.

The second booklet gives information on the use of Douglas Fir Plywood for concrete forms, with details of typical plywood forms, deflection graphs, and photographs of jobs in which Fir Plywood gave smooth, flawless surfaces without rubbing, speeded up work and reduced labor costs.

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Ryerson Sales Convention

A large group of the marketing organization of *Joseph T. Ryerson & Son, Inc.*, took part in a three-day national sales convention recently, arranged by H. B. Ressler, vice-president in charge of sales, at the Chicago plant. President Edward L. Ryerson welcomed the group.

●

Carnegie Handbook

T-Tri-Lock Bridge Floor Construction is the title of a recent handbook issued by the *Carnegie Steel Company* of Pittsburgh. Structural tees in combination with lighter flat bars mechanically interlocked with the tees form this light weight floor construction, which should be welded to the supporting beams and then filled with concrete to form an armored road surface, according to the company.

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Cement Mill Section of
Concrete

FEBRUARY
1934

Processed Masonry Cement Captures Rapidly Growing Market

Industry Should Draw Line Between Purely Mechanical Mixtures and Those Masonry Cements Developed Through Control of Chemical Reactions in Manufacturing Process—Logical Expansion for Cement Manufacturers

By ALTON J. BLANK
General Superintendent and Supervising Chemist, Compania de Cemento Portland "Landa," S. A.,[1] Puebla, Mexico

THE author of this article gives expression to a thought that has been entertained by many others. " A line should be definitely drawn," he writes, "between those so-called masonry cements that are the result of mechanical mixtures of materials, or of materials admixed to known and established products such as lime and cement, and those developed masonry cements that are the result of chemical combinations formed in the process of manufacture. As the name 'portland' is so definitely and jeasously guarded in connection with that type of cement, so should a definite name for legitimate masonry cement be arrived at and treated in a like manner."

This should be a matter of vital interest to manufacturers of portland cement, for they are the logical producers of the developed masonry cements to which reference is here made—the "legitimate" masonry cements, as the author calls them.—*Editor.*

IN the masonry field we have with us brick-laying, block-laying, plastering and stuccoing. For two thousand years or so, lime, through lack of a competitive product, "ruled the roost," not only in this field but in allied fields, and prospered. During the past fifty years or so lime has had to yield a part of its masonry kingdom to portland cement, and the latter product prospered at the expense of lime. Of more recent date a number of masonry cements have made their appearance in the field primarily controlled by lime, later shared with portland cement, and these masonry cements have prospered at the expense of both lime and portland cement in the general "march of progress."

In a paper presented before the eighth annual convention of the National Lime Association, 1926, entitled "There Is No Substitute," J. S. Elwell advanced a number of reasons why there was "no substitute" for lime in the brick-laying, plastering and stuccoing departments of the masonry field, and in a spirit of fairness to the cement industry asserted that "Lime-cement mortars were satisfactory in spite of, rather than on account of, the added material." The added statement, however, to the extent that "In hot, dry Mexico lime stucco is used exclusively today just as it was generations ago," was at that time slightly exaggerated, and is today almost a myth. A further statement to the effect that "Lime mortar is all that a mortar should be" was at that time questionable, and in the light of present-day developments and uses of mortar, the above statement can not be termed as entirely correct. On the other hand, statements issued by manufacturers of portland cement, from time to time, to the effect that portland cement fills the long-felt need in the masonry field, may also be termed as incorrect.

The nearest approach to truth in the controversy that has held sway for years between the lime and portland cement interests and their representatives is the statement that a lime-cement product is more satisfactory as a masonry material than is either lime or portland cement when used alone. However, this does not necessarily mean that lime-cement products are the "ideal" masonry materials.

Opportunity for Processed Masonry Cements

An unbiased treatment of this matter is to be found in the paper presented by J. C. Pearson before the annual convention of the American Concrete Institute, 1932, entitled "Properties and Problems of Masonry Cements," in which is stated: "Since neither portland cement alone nor lime alone makes a good masonry cement for general use, and since there is no reason why other materials than cement-lime mixtures should not make good masonry cements, there has long existed an opportunity for manufacturers to produce masonry cements as a finished product, and to put them on the market in competition with natural, puzzolan, and other cements largely used for this purpose."

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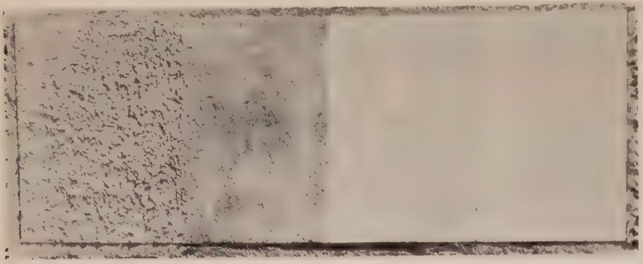
[1] Also Director of Research, Cement Process Corporation.

During the past few years a number of "masonry cements" have made their appearance, the manufacturer of each new product claiming this and that superiority for his product over each and every one of the existing products in use in the masonry field.

As a result, the masonry field has been flooded with new words and terms having to do with the properties and qualities of masonry cements to the extent that it finds itself in a state of bewilderment. From this bewilderment it has not as yet emerged, notwithstanding its practical experience plus the intentionally helpful, though somewhat confusing explanations of theorists and scientists related and unrelated to the masonry field. However, such a state of affairs usually makes for progress.



First three panels from left to right show use of new masonry cement in stucco, proportions being 1:3, 1:8 and 1:4 parts of cement and river sand. Panel at right is smooth wall plaster of neat cement

Little Advantage in Mechanical Mixtures

Of the new masonry cements developed, the majority, it may be said, are purely mechanical mixtures in which natural, portland and other cements, together with slags, diatomite and similarly active materials are used in connection with limes, hydraulic or otherwise. Such cements are not to be considered as having any marked advantage over a similar product which may be easily prepared by the user at the time of use, and at a savings over the prepared product.

For example, portland cement and lime are mixed together and, notwithstanding the fact that the lime is chemically inert in the presence of the cement, the product, though only mechanical in design, becomes a masonry cement having mysterious compounds, properties and qualities, and its methods of manufacture becomes a closely guarded secret. That such a masonry cement can be used to advantage in certain types of masonry work, is not questioned. That it is the ideal masonry cement for all uses to which masonry cements are put, is indisputably questioned. The same holds true for other masonry cements produced mechanically from materials in general, as listed above.

Should Be Result of Chemical Reactions

In the main, masonry cements should, as in the case of portland, iron, alumina and like processed cements, be the development of chemical reactions between the materials from which they are produced, at the time of production. High temperatures, heretofore thought necessary to bring about reactions and the formation of compounds between lime and siliceous or argillaceous materials, has had a tendency, due to costs involved, to retard the development of a masonry cement that would be suitable for use in all work in the masonry field. As a result, artificial products derived through the mechanical mixing of two or more materials having hydraulic or otherwise desired properties, have been produced, none of which have proved to be the ideal masonry cement for use in brick-laying mortar, plastering or stuccoing mortar as a whole. It is true that some of the so-called masonry cements have been found suitable for a given use, but none (to the writer's knowledge) have been found equally suitable or adaptable for all of the uses to which a masonry cement is put.

A Definite Distinction Needed

In the writer's opinion, a line should be definitely drawn between those so-called masonry cements that are the result of mechanical mixtures of materials, or of materials admixed to known and established products such as lime and cement, and those developed masonry cements that are the result of chemical combinations formed in the process of manufacture. As the name "portland" is so definitely and jealously guarded in connection with that type of cement, so should a definite name for legitimate masonry cement be arrived at and treated in a like manner.

As has been stated before, the production of cement has in the past been associated with high temperatures. To the practical man high temperatures denote high costs of production; but for lack of any other definite method of producing cement, it has been, and is still being, produced to a large extent by the high-temperature procedure.

Processed Masonry Cements at Low Cost

New developments in the cement field have resulted in the production of improved cements in the low temperature field, over those cements produced in high temperatures. Thus, cements for any specified use, ranging from the masonry cement field through cements of the portland and super types, are possible of production from the usual raw materials at lower costs than have heretofore been thought possible, and by a simplified process which involves the use of less labor and lower plant investment. This process has been described in previous articles (see the *Cement Mill Edition* of CONCRETE, issues of July, September and December, 1933, and the August 25, 1933, issue of *Rock Products*).

Lime is hydrated in the presence of finely divided siliceous and/or argillaceous materials and ground in any of the usual type of tube or compeb mill under controlled moisture and temperature conditions to produce masonry cements. The proportions of calcareous or other lime and the siliceous and/or argillaceous material are varied, as is the moisture and temperature control exercised during the manufacturing procedure, in order to insure the proper reactions, and to obtain the quality or type product desired. With certain materials it is advantageous to add a small proportion of cement clinker after the hydration stage of the procedure, but previous to the fine grinding stage of the process. This addition of cement clinker, usually from several to as high as ten per cent of the mixture, acting as a catalyzer, effects further reactions and combinations during the grinding under controlled moisture, temperature and fineness conditions, resulting

Left: Example of effect in smooth stucco obtained with new masonry cement. Store and apartment building in Mexico City. Right: Example of use of new masonry cement in brickwork. Apartment and office building in Mexico City

in the production of masonry cements suitable for all known uses. Thus the chemical composition may be identical to that of portland cement, or it may be varied somewhat so as to have a higher or lower lime or silica content. Similarly, variation in the manufacturing procedure may result in products of extremely high strength when desired, and in normal, slow or accelerated setting qualities.

For Manufacturers of Cement and Lime

The process places the lime and cement manufacturers on an equal footing in the production of masonry cements, since they, with a few inexpensive alterations or additions to their present plant equipment, and with the raw materials available, are in a position to produce, at a very low cost, the type of masonry cement that has long been awaited by the cement-using public.

Under the process in question, Compania de Cemento Portland "Landa," S.A., has been producing a masonry cement for the Mexican market during the past few months. This cement, marketed under the trade name "Plastocement," has made great inroads into the field formerly supplied by lime and portland cement, which had heretofore been used exclusively, alone or together. Under the same process a cement was launched under the trade name "Atoyac" in direct competition with portland cement, in which market the new cement has made such headway that it now occupies 20 per cent of the field formerly controlled by the portland cements produced in the several plants.

Demand Exceeds Peak Year of 1930

In the few months the new cements have been on the market they have climbed to the point where "Plastocement" sales from the Landa plant have been in excess of capacity and equal to the Landa portland cement sales during the year 1932. Similarly, "Atoyac" sales have also equalled the Landa portland cement sales during the year 1932, while the combined sales of both processed cements on a monthly average have far surpassed those experienced by the Landa Company during the peak year 1930. The demand for the new products is increasing at the present time to the extent that necessitates the installation of additional processing equipment. Of interest in this connection is the fact that a greater tonnage of the processed cements is being produced with a reduction in the plant personnel of approximately 35 per cent.

While this has resulted in a decided departure from the methods previously in use in the manufacture of masonry and of high-strength cements, it has proved to be a step in the right direction, namely, the production of cements at costs that have heretofore been thought unbelievable, at the same time satisfying the demands of the public for cements adaptable to all purposes. Contrary to declarations made some time ago by P. H. Bates before the Annual Meeting of the American Society for Testing Materials,[1] there are now being produced "all-purpose cements."

Acknowledgment

The process of manufacture here described has been developed by the Cement Process Corporation, for which the author is acting as director of research.

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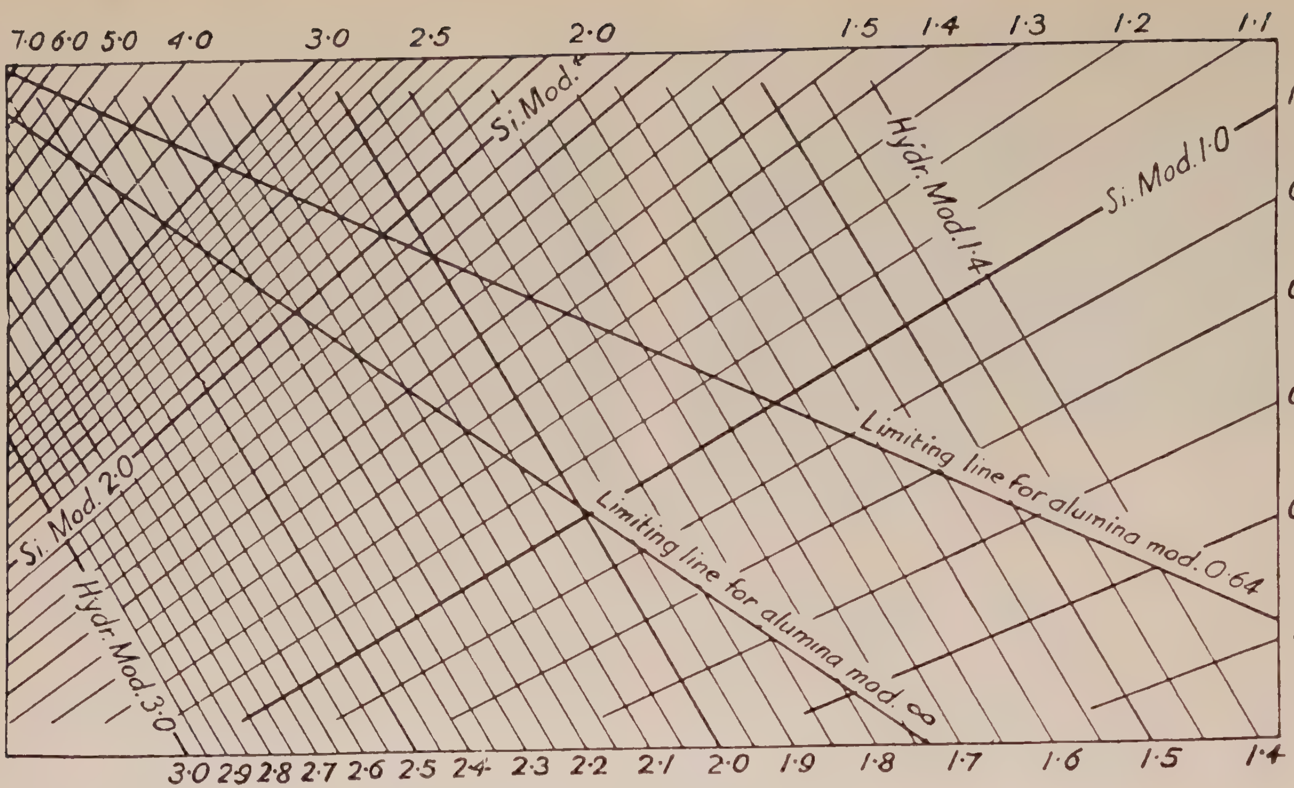
[1] See abstract of paper by P. H. Bates in August (1933) issue of CONCRETE, pages 3 and 4.

Cement Code Authority Headed by Rader

B. H. RADER, vice-president and western sales manager of the Lehigh Portland Cement Company, is chairman of the code authority of the cement manufacturing industry.

The seven industry members announced by the Cement Institute include Mr. Rader, as chairman; Robert B. Henderson, president of the Pacific Portland Cement Company; C. L. Hogan, president of the International Cement Corporation; L. T. Sunderland, president of the Ash Grove Lime and Cement Company; M. C. Monday, president of the Cumberland Portland Cement Company; J. B. John, president and general manager of the Medusa Portland Cement Company; and George F. Coffin, secretary-treasurer and general manager of the Nazareth Cement Company. Barton W. Murray is the NRA representative.

The industry members of the code authority were elected by the board of trustees of the Cement Institute. Headquarters of the code authority have been established at 111 West Washington St., Chicago, Illinois, the office address of Chairman Rader.



Nomogram for determining lime content

Determining Maximum Lime Content of Portland Cement

Results of Experiments Presented—Convenient Nomogram Sufficiently Accurate for Use in Kiln Control

IN evolving the lime saturation factor (L.S.F.) Kühl did not take into account the presence of brownmillerite ($4CaOAl_2O_3Fe_2O_3$), the existence of which was not then established. Now that it has been proved that this compound exists, Kühl's formula must be modified as follows:

Original formula—

$$L.S.F. = \frac{100\ CaO}{2.8\ SiO_2 + 1.65\ Al_2O_3 + 0.7\ Fe_2O_3}$$

Revised formula—

(a) For cements of alumina modulus above 0.64 (Portland)—

$$L.S.F. = \frac{100\ CaO}{2.8\ SiO_2 + 1.65\ Al_2O_3 + 0.35\ Fe_2O_3}$$

(b) Alumina modulus less than 0.64 (iron ore and Kühl cements)—

$$L.S.F. = \frac{100\ CaO}{2.8\ SiO_2 + 1.1\ Al_2O_3 + 0.7\ Fe_2O_3}$$

It is well known that in practice L.S.F. 100 can be attained with some cements, but with others L.S.F. 90 to 95 is the maximum possible. There must be factors in the technical burning process which the L.S.F. does not take into account. A study of these has been made by burning various mixtures in an experimental furnace and by consideration of the Rankin (CaO-Al_2O_3-SiO_2) diagram.

In a preliminary series of experiments it was found that there is a definite temperature (1,450 deg. C. for iron-free cements and 1,350 for cements containing equivalent proportions of Fe_2O_3 and Al_2O_3) above which no further combination occurs, even when the mix is adjusted so that there remains several per cent of free lime in the clinker. From determinations of the free lime remaining in the clinker the composition of the "ideal" cement can be calculated. This was done for several mixes, and in every case the "ideal" lime content was less than the theoretical value; it ranged between L.S.F. 91.3 and 97, while theory requires L.S.F. 100.

The results of a second series of experiments on iron-free mixes, interpreted by means of the Rankin diagram, showed that the formation of cement on clinkering is due to the separation from the liquid phase of solid tricalcium silicate and to a less extent tricalcium aluminate. Solid lime and silica are continuously dissolved by the melt and tricalcium silicate is continuously thrown down, and almost perfect equilibrium is attained. The liquid phase is suddenly formed at 1,455 deg. C. and the reactions occur between 1,455 and 1,470 deg.; the siliceous melt is not saturated with CaO. With rapid cooling the 1,470 deg. equilibrium is perpetuated, but with slower cooling there

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Abstract of paper in *Zement*, by E. Spohn, as published in July (1933) issue of *Cement and Cement Manufacture* (London).

is some departure from it. The technically attainable maximum lime content is given by a line joining (on the Rankin diagram) tricalcium silicate and $2CaO.Al_2O_3$, turning off at two-thirds of its length toward tricalcium aluminate. The CaO content represented by this line is less than the thoretical content given by the L.S.F.

The third series of experiments comprised mixes containing Al_2O_3 and Fe_2O_3 in equivalent proportions, as found in brownmillerite, the burning temperature being 1,420 deg. C. In this case the solid phases which separate from the melt are tricalcium silicate and brownmillerite. The liquid phase is saturated with lime and is nearly free from silica. Complete equilibrium is also attained in this case. In these cements the maximum lime content is correctly represented by the L.S.F., which can attain the value of 100. The maximum lime content corresponds to the line joining tricalcium silicate and brownmillerite.

Normal portland cements can be considered as approximating to iron-free cements. For these it would be necessary to replace the L.S.F. by a complex formula, and a graphical method is preferable. A nomogram for the purpose is shown in the figure, in which the hydraulic and silicate moduli are represented by a network of lines. The maximum lime line is given both for iron-free cement (alumina modulus 0.64) and brownmillerite cement (alumina modulus infinity); these represent the two limits between which the maximum lime content will vary. The point representing any cement is the intersection of its hydraulic and silicate moduli, and its distance from the limiting lime line is a direct measure of the extent to which its lime content is too high or too low. This nomogram gives a satisfactory degree of accuracy and will be found very useful in kiln control. It does not, of course, take into account such factors as alkalis, magnesia, coal ash, etc., but it is not in general necessary to consider these in calculating the lime content.

Phosphorus Content of Raw Materials Must Not Be Ignored

Presence, If Undetected, May Upset Calculations—Test Procedure Described—Example Shows Importance

IT is strange to observe that the great majority of the textbooks on portland cement manufacture do not refer to the part played by phosphorus in the raw materials, although other impurities such as alkalis, magnesia, and sulphuric anhydride are always commented upon. The matter is important, however, and certain manufacturers have paid dearly for their ignorance in this connection.

In the case under notice, phosphorus combined with lime occurred in certain layers of chalk in the form of tricalcic phosphate—a very stable compound and quite undecomposed by heat except under certain conditions, such as in the presence of silica and carbon at the temperature of the electric furnace, or, in other words, in the presence of silica under reducing conditions at very high temperature. These conditions are absent in the rotary kiln where the temperature is lower and the atmosphere is oxidizing. Consequently it follows that lime combined with oxide of phosphorus in the state of $3CaO.P_2O_5$ can not combine with the silica, alumina, and iron oxide of the clay in the raw material mixture.

Phosphatic chalk is of the type known to geologists as Turonian, a hard chalk having a yellowish-grey appearance, irregularly striated with brown streaks of iron oxide and speckled with very small dull grains of glauconite. It is thus easily recognizable; and in distinction to this, white chalk of the Senonian series contains no phosphorus.

It may appear extraordinary that in the chemical analysis of samples from a chalk deposit the presence of phosphorus can be undetected, but the reason is that, if the precaution of making a special test for this element is neglected, the phosphorus is contained in the precipitate of alumina and iron oxide; and not only is it ignored in the analysis, but it falsifies the determination of the alumina and iron oxide. It is therefore desirable that the examination of a deposit intended for cement manufacture should include a special test for phosphorus.

The Test Procedure

A method for the determination of phosphorus which has given excellent results is as follows: Boil 1 gm. of the material for 10 minutes with 40 ccm. of concentrated HCl diluted with an equal volume of water. Filter and add to the filtrate 100 ccm. of a solution composed of 100 gm. $MgCO_3$, 400 gm. citric acid, and 600 ccm. ammonia, made up to 1,500 ccm. with water. When preparing this solution the ammonia should not be added until the reaction between the citric acid and $MgCO_3$ is complete and all CO_2 dispersed. After addition of the 100 ccm. of this solution, add ammonia drop by drop until alkaline, then make strongly ammoniacal by adding 50 ccm. of concentrated ammonia. Stir vigorously until after a time a precipitate of magnesium ammonium phosphate is formed, then allow to stand for 12 hours before filtering, washing with 20 per cent ammonia solution, and calcining to $Mg_2P_2O_7$.

Taking as an example a phosphatic chalk containing 5.44 per cent P_2O_5 and 47.86 per cent CaO, there would be present 11.87 per cent tricalcic phosphate not decomposable in the rotary kiln, and thus leaving only 41.37 per cent of lime available to combine with argillaceous elements. This corresponds to only 73.88 per cent $CaCO_3$, which is much less than the requirement for a cement slurry. Such an example shows that, even though the impurity may remain inert in the finished cement, its presence can not be ignored in the raw materials.—By Henri Martin, in *Cement and Cement Manufacture*, Feb., 1933.

✦ EDITORIAL ✦

Those Unprofitable Plants

THE code of fair competition for the cement industry makes it perfectly clear that the provisions designed to discourage increase in capacity shall not be construed in any sense as being antagonistic to the modernization of existing plants for the purpose of improving the quality of the product or reducing operating costs.

From this it becomes increasingly plain that "plant rehabilitation is the way out" for a considerable number of the manufacturing units of the industry.

The words just quoted formed the subject of an editorial in our November (1933) issue. As suggested in that editorial, general price advances at this time would probably be frowned upon—and in any event such a move would be poor business strategy.

While at present mill prices and under the present relation between production and capacity not many plants can operate at a profit, some can improve their position immensely by means of a complete rehabilitation of the part of their capacity needed for 1934 business.

Complete rehabilitation does not necessarily mean the scrapping of the larger machinery units such as rotary kilns and tube mills. It does call for the installation of modern accessories as hook-ups with the larger units. For illustration, modern clinker coolers, designed to return the recuperated heat to the kilns, act as preheaters of the secondary air entering the kilns. Such installations will reduce fuel and grinding costs and improve the quality of the product.

Again, efficient air separators hooked up with the grinding units will reduce grinding costs and improve the fineness distribution. Old conveying systems may need replacement with modern cement pumps, and dust collecting systems may in some cases pay for themselves in the value of the product recovered.

Every plant, of course, is an individual problem, and its rehabilitation demands thorough study and careful planning in advance; but the one outstanding fact that applies to all unprofitable plants is that reduced manufacturing cost is about the only channel through which a margin of profit may be attained.

Suspends Code Provisions on Marketing

IN an Administrator's order issued by General Hugh S. Johnson on January 23, all members of the cement industry are exempted from the operation of certain disputed sections of the code's Article XI, dealing with methods of selling and marketing.

The controverted sections were the subject of voluminous testimony at a public hearing on proposals for their modification, conducted by acting deputy administrator B. R. Value, on January 15 and 16. At that time several scores of witnesses were present to voice the protests of materials dealers, state purchasing bureaus and others, against various of the now suspended provisions contained in the code as approved on November 27.

Under the order issued by General Johnson, the only section of Article XI which remains in effect is the one designating a method by which the weights of delivered cement are to be computed. All other sections of the article are suspended until such time as modifications, to be submitted by the code authority for the cement industry, are given due hearing and have received the approval of the administrator.

The order of exemption and exception was issued upon recommendation of division administrator W. A. Harriman. He was joined in the recommendation by deputy administrator Barton W. Murray, administration member of the code authority for the cement industry.

Doubtless the cement men comprising the code authority, aided by others who for many years have worked toward a settlement of this troublesome question of selling and marketing, will prepare the strongest possible case in order that the position of the cement industry may be maintained.

Cement Plant Promoter Active Again

THE El Paso (Texas) "Herald" of January 6 reports renewed activities by E. S. Gates, one of the promoters of a small cement plant built at Chubbuck, California, in 1928, and known as the National Portland Cement Co. The plant has one small kiln, 5 by 50 ft.

From reports in cement directories there is no evidence that the Chubbuck plant ever was in sustained operation. In fact, a petition recently filed by the attorney general of Texas, seeking to forfeit the National Portland Cement Co. charter, contends that the plant has not been operated; and that it was originally organized by promoters who owned feldspar deposits in California. The Gates Chemical Co. owned the deposits.

Briefly, this is the reported background on which Gates is now offering stockholders of the National Portland Cement Co. more stock for the formation of a new company, to be known as the International White Cement Co. of Nevada, and which, he says, is to buy an existing plant in Los Angeles, Calif. Gates formerly was president of the Midwest Investment Co.

Cement manufacturers of California and the southwest will, in all probability, investigate this matter with the view of taking such action as the situation may demand.

Accurate Laboratory Air Separator Provides Data on Quality

Onoda Plant in Japan Maintains Constant Check on Fineness of Product—Apparatus, Procedure and Test Results—Accuracy Is Verified

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Onoda Cement Company, Ltd., Japan

(From the Journal of the Society of Chemical Industry, Japan.)

THE author has constructed a laboratory air separation apparatus which enables him to determine within 30 minutes the residue from 50-g samples, taking 16 microns Stokes' diameter of cement particles as the conventional boundary size, just as we separate by sifting with 4,900 or 10,000-mesh sieve,[1] the boundary size being 88μ and 60μ respectively.

General Data

The limit velocity for 16μ cement particles calculated from Stokes' Law, which fairly well applies to cement particles of less than 30 to 40μ, is 2.4 cm/sec in 20 deg. C. air. In operating the air separator, the author kept the velocity of air current in the separating tube whose inner diameter is 15 cm at 2.7 cm/sec in order to blow off the 16μ particles. The air required for the separation, therefore, is $2.7 \times \pi/4 \times 15^2 = 477\ \text{cm}^3/\text{sec}$. The quantity of air, it has been experimentally confirmed, is most suitably supplied with the nozzle of 3 mm diameter at a pressure of 300 mm water column as measured behind the nozzle.

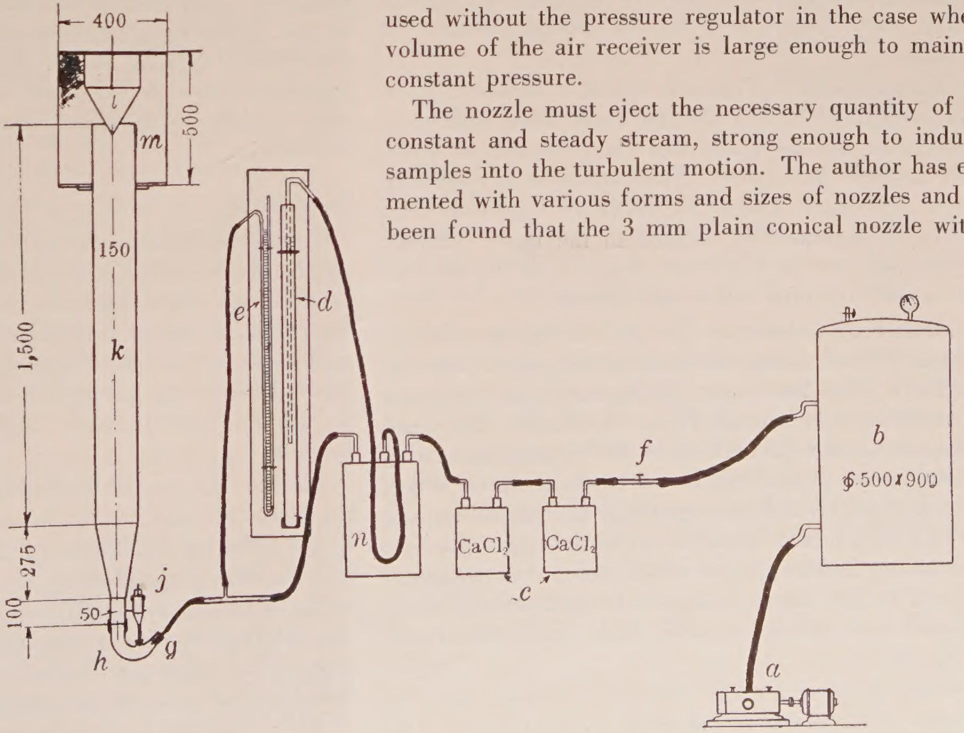

Figure 1. Diagrammatic arrangement of laboratory air separator. Parts indicated by letters are: *a*, rotary compressor; *b*, air receiver; *c*, moisture separators; *d*, pressure regulator; *e*, monometer; *f*, valve; *g*, nozzle; *h*, mixing chamber; and *j*, sample-feeder

(I) *Construction of the Apparatus*

The air separating consists of three processes, namely—

(1) Air supplying at constant rate.
(2) Mixing of air and cement particles.
(3) Separating the cement particles.

The apparatus is composed according to this principle as diagrammatically shown in Figure 1.

(1) Air Supplying at Constant Rate

There are installed a rotary compressor *a*, air receiver *b*, moisture separator *c*, pressure regulator *d*, manometer *e*, valve *f and* nozzle *g*. They are connected by the rubber tubes and air hoses as shown in the figure. The compressed air discharged from the compressor *a* is conducted into the receiver *b* and passes successively through the regulation valve *f* and the drying vessel *c*, the latter containing anhydrous $CaCl_2$. The dried air is blown into the elutriator *k* by means of nozzle *g*. Between the nozzle and the dryer there are provided manometer *e* and pressure regulator *d*. When the air pressure is rising over the prescribed head of the manometer *e*, the pressure regulator *d* makes the excess of air bubble out through the water-sealed glass pipe, thus automatically adjusting the pressure and the manometer head. The apparatus may be used without the pressure regulator in the case when the volume of the air receiver is large enough to maintain a constant pressure.

The nozzle must eject the necessary quantity of air in constant and steady stream, strong enough to induce the samples into the turbulent motion. The author has experimented with various forms and sizes of nozzles and it has been found that the 3 mm plain conical nozzle with 300 mm air pressure behind the nozzle is quite suitable to our purpose.

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[1] Equivalent, respectively, to 178 and 254 meshes per lin. inch.

(2) Mixing of Air and Cement Particles

The time of air elutriation depends largely on the perfect and intimate mixing of air and cement samples. The factors leading to the complete mixing are proper form of the mixing chamber, suitable nozzle size and air pressure, feeding device effective to dispersion and the expulsion of moisture from the samples. If these factors are correctly taken into consideration the shortening of separating time is a matter of certainty.

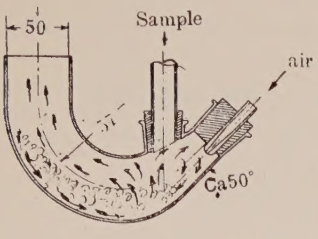

Figure 2 (above). Enlarged view of mixing chamber *h*

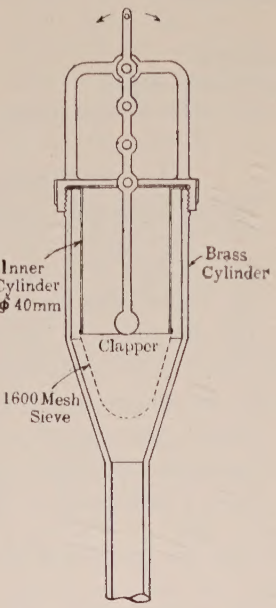

Figure 3 (at right). Detail of sample-feeding device, shown also at *j*, in Figure 1

As to the mixing chamber, the author has experimented with several forms, such as circular U-shaped or V-formed, and finally adopted the conical glass tube *h*, Figure 1, curved in U-shape, which is connected to the lower end of the separating tube *k* by means of a piece of rubber tube. Figure 2 shows the mixing chamber in larger scale.

The sample-feeder *j*, Figure 1, which is mounted upon the mixing chamber *h*, is a circular brass vessel with conical lower end. In the vessel there is provided an inner cylinder made of brass sheet. The bottom of the cylinder carries a 1,600-mesh screen[2] as shown in Figure 3. The sample to be separated is charged in the inner cylinder and is dropped into the U-tube by clapping the inside wall with a clapper provided within the cylinder.

The disturbing of samples in the mixing chamber is carried out in such a manner that the sample, as soon as it falls down from the feeder, is dispersed and kept in a turbulent motion by the air from the nozzle. The finer particles are at once carried off to the separating tube *k*, while the coarser grains fall down in the chamber which the impact of air jet induces repeatedly into turbulent motion. The grains blown further away to the upper position of the chamber and the grains which return from the separating tube to the chamber slip back continuously along the inclined wall and are steadily subjected to the impact of the air jet.

The relation between the time of elutriation and the decrease of residue in the mixing chamber was studied with various quantities of the same samples, viz. 50, 70, and 100-g. The result is plotted in the diagram Figure 4, which shows that the more the quantity, the longer is the time of elutriation needed. The end of separation for 50-g is practically reached in 30 minutes and for 70 and 100-g in 1½ hours or more.

Another experiment was executed on five different cement samples to compare the results obtained after 30 minutes and 60 minutes elutriation. The very small difference of less than 1 per cent as shown in Table 1 confirms that 30 minutes test is quite sufficient.

TABLE 1. SEPARATION TIME AND PERCENTAGE OF RESIDUE

Sample No.	30 Min.	60 Min.
1	61.0	60.2
2	61.4	60.4
3	60.8	60.0
4	61.2	61.0
5	61.8	61.2

When moisture is present in the samples, even if it were only a few per cent, it effectively binds the fine particles and retards the separation. Hence, previous drying of the sample is necessary for economy of separating time.

(3) Separating the Cement Particles

The process is performed in the separating tube and the dust chamber. The separating tube *k* in Figure 1 is a brass cylindrical tube of 15 cm inner diameter and 187.5 cm long. The lower end of the tube is cone shaped to prevent the eddy current of the air. The cement particles are elutriated into fractions in the tube by the air current of constant velocity, 2.7 cm/sec. The particles larger than 16μ fall back into the mixing chamber, while those less than 16μ are raised by the air flow.

The air current carrying the particles less than 16μ rises through the separating tube, above which it is deflected by the cone *l* and reaches the dust chamber *m* covered with flannel cloth where the relatively coarser particles, amounting nearly to ¾ by weight of the fraction below 16μ, are separated from the air while the finest portion is carried away by the escaping air through the vent of the dust chamber.

Accuracy

To ascertain whether the fractions obtained from the apparatus described are correctly separated at limit size as expected, the author has sampled the fractions out of the residue in the mixing chamber *h* and the deposit in the dust chamber *m*. In comparing their microphotographs we don't find any perceptible difference between the sizes of the smallest particles from *h* and the largest ones from *m*.

Further, the author measured directly the grain sizes of the same samples as above mentioned under the microscope. The measurement has been carried out in such a manner that perpendicular two dimensions of nearly 100 particles along arbitrarily selected direction in the field are determined with a filar micrometer eyepiece and the geometrical mean of the two dimensions of the particles had been adopted as its diameter. Table 2 shows an example from results of such measurement.

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[2] Equivalent to 102 meshes per lin. inch.

Figure 4. Relation between time of elutriation and decrease of residue in mixing chamber

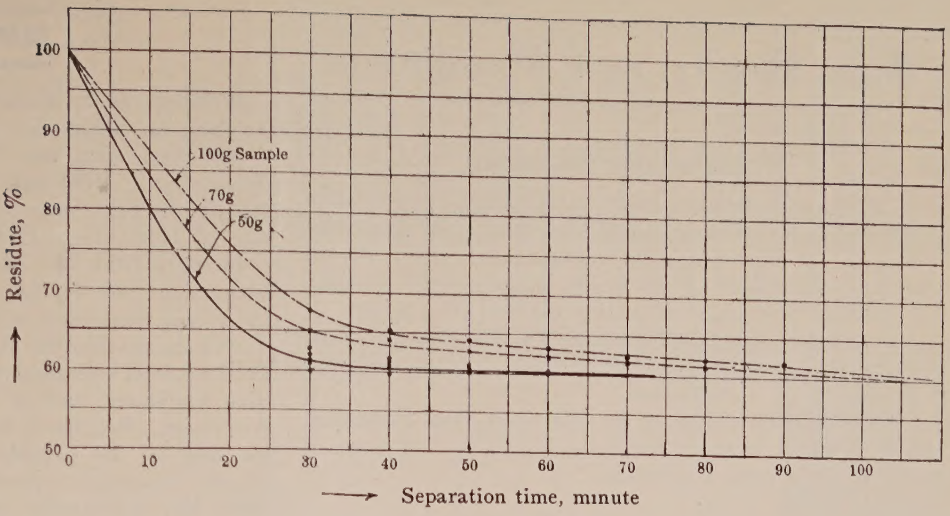

TABLE 2. RESULTS OF THE MICROSCOPIC MEASUREMENT

	Fraction					
	Fraction from *m*			Fraction from *h*		
		Greater than 16μ			Less than 16μ	
Test No.	Number of particles observed	Number of particles	Diameter of particles, μ	Number of particles observed	Number of particles	Diameter of particles, μ
1	103	5	16.8—20.4	107	1	16
2	103	1	16 —19.2	111	3	11.5—16
3	103	3	16.8—22.8	115	2	13.8—16
4	100	5	16.8—19.2	105	4	16
5	104	3	16.8—20.4	100	5	16

As derived from Table 2, the average deviation from the ideal accuracy amounts to 3 per cent by particle number. The deviation in the fraction *m*, will be lowered below 2 per cent by taking into account the lost fines from the vent of the dust chamber.

(II) *Practice of the Air Separation in Daily Test*

Briefly resuming, a 50-g normal portland cement sample can be separated at the boundary size of 16μ diameter within 30 minutes under the following conditions:

(1) Dry the sample thoroughly, if wet, at 110 deg. C.

(2) Use the separating tube of 15-cm inner diameter.

(3) Apply the mixing chamber shown in Figure 2 and sample feeding device (Figure 3) attached with 1,600-mesh sieve.

(4) Supply the dried air with 3-mm nozzle at a pressure of 300 mm by water column behind the nozzle.

The Onoda Cement Company is operating the apparatus under these conditions for the daily controlling of the fineness of the normal portland cement, and testing of the extra fine cement.

Normal Portland Cement: Table 3 is the test results of the normal portland cement produced by the Odona Cement Company. The content of fine fraction smaller than 16μ amounts to 40-43 per cent.

TABLE 3. DAILY TEST RESULTS OF NORMAL PORTLAND CEMENT

	Date									
Fraction	July 9	10	11	12	13	14	15	16	17	18
Per cent of fraction larger than 16μ (weighed)	60	59	58	59	57	58	60	58	58	59
Per cent of fraction smaller than 16μ (calculated)	40	41	42	41	43	42	40	42	42	41

Extra Fine or High Early Strength Portland Cement: The extra fine portland cement produced by the company and other high-quality portland cements in the market tested with the apparatus show the fineness indicated in Table 4.

TABLE 4. TEST RESULTS OF EXTRA FINE AND HIGH-QUALITY PORTLAND CEMENT

	Sample			
Fraction	Onoda extra fine	A	B	C
Per cent fraction larger than 16μ (weighed)	46	55	50	58
Per cent fraction smaller than 16μ (calculated)	54	45	50	42

The fineness of the high-early-strength portland cement ranges from 42 to 54 per cent of fines smaller than 16μ.

Acknowledgements: The author wishes to express his gratitude to Dr. Kasai, President of the Onoda Cement Company, Ltd., for his advice, and to Y. Kawano for the microscopic measurement of particles.

Expect Increased Cement Shipments

BASED on reports submitted at the tenth annual meeting of the Atlantic States Shippers' Advisory Board held at New York on January 4, commodity carloadings throughout the middle Atlantic states during the first quarter of 1934 are estimated to average 11.5 per cent more than actual shipments handled during the corresponding quarter of 1933. Actual and estimated figures for cement and other construction materials are:

	Carloads in First Quarter Actual, in 1933	Estimated, for 1934	Estimated increase, per cent
Cement	9,438	10,618	12.5
Gravel, sand and stone	10,848	12,822	18.2
Lumber and forest products	7,486	7,486	Same
Iron and steel	13,167	19,750	50.0
Brick and clay products	1,082	1,222	12.9

Total shipments for all commodities, in the middle Atlantic states during the first quarter of 1934, are estimated at 469,404 carloads, compared with 420,867 carloads actually shipped in the first quarter of 1933.

On the same date the Midwest Shippers' Advisory Board, at its annual meeting in Chicago, estimated first quarter shipments in its territory at a total of 671,000 carloads, an increase of 10 per cent above the actual shipment of 610,400 carloads in the first quarter of last year. The estimated increase in shipments of cement was 10 per cent; for gravel, sand and stone, 10 per cent; for lumber, 25 per cent; for forest products, 15 per cent; for iron and steel, 20 per cent; and for brick and clay products, 38 per cent.

New Books and Pamphlets

Booklet on Silicosis

SILICOSIS is the title of a 32-page paper-covered booklet published by the Metropolitan Life Insurance Company.

Because of the increasing prominence given to the effects of silica dust on the health of industrial workers, this booklet is written especially for the information of plant superintendents and foremen. It also presents useful suggestions for the control of dusty processes arising in the course of manufacture.

Copies may be obtained by addressing the Industrial Health Section, Metropolitan Life Insurance Company, 1 Madison Ave., New York City.

PERSONALS

Appointment of *C. S. McArdle* as sales manager of the Kansas City, Mo., office of the Universal Atlas Cement Co., and *Fred T. Wiggins* as salesmanager of the company's Birmingham, Ala., office was announced January 2 by F. L. Stone, vice president and general sales manager of the Universal Atlas company. Mr. McArdle succeeds S. H. MacArthur, resigned, and Mr. Wiggins takes over the position formerly held by Mr. McArdle.

H. F. Tyler, vice-president of the Dewey Portland Cement Company, has been elected president of the Davenport (Iowa) Manufacturers Association, a bureau of the Chamber of Commerce.

Cement Statistics Delayed

Cement statistics for December—and for the full year of 1933—have not been received as this issue goes to press. The delayed figures will appear in the March issue.

OBITUARY

William Dun Armstrong passed away at Calgary, Alberta, on September 8, 1933.

Mr. Armstrong was born at Owen Sound, Ontario, on November 2, 1890 and was educated at the Owen Sound school, the University of Toronto and the Provincial Institute of Technology, Calgary.

In 1910-1911 Mr. Armstrong was with the Canadian Inspection and Testing Laboratories, and from 1912 to 1914 was connected with the mechanical department of the Canadian Pacific Railway Company at Toronto. In 1915 he went overseas with the 6th Field Company, Canadian Engineers, and in 1917 was transferred to the Royal Air Force. Returning to this country in 1919, he joined the staff of the Canada Cement Company, Limited, and became assistant superintendent at Winnipeg. In 1921-1923 Mr. Armstrong was engineer for the company at Exshaw, Alberta, and in 1923 was appointed plant superintendent at Exshaw, which position he held up to the time of his death.

In 1924 Mr. Armstrong organized and superintended a successful piece of hydraulic engineering work—the removal of over 65,000 cubic yards of overburden from the mountain-side quarry at Exshaw. Always an energetic safety engineer, he cleared up by this means the principal danger hazard in the quarry, at a cost of only thirteen cents a cubic yard, at the same time making the entire slope available for continuous quarry operation. His description of this work was awarded a prize by the Engineering Institute of Canada, and will be found in the July, 1925, issue of the *Engineering Journal.*

Under his superintendence the Exshaw plant had a no-accident year in 1923, and won the Portland Cement Association Trophy for a no-accident year in 1928 and 1930. In June, 1933 his plant was reported on the Thousand-Day Club with 1,297 days to its credit.

His sudden death was deeply felt by his many friends and associates of all grades in the West and the East, who remember him as a genial companion, a fairminded boss and a competent engineer.

Harry Stauffer Hartzell, chief chemist of the Coplay Cement Company for twenty-five years, passed away on December 28, after a short illness with pneumonia. During the last several years Mr. Hartzell did consulting work. He was an active member of the American Society for Testing Materials.

MILL EQUIPMENT

License to Manufacture Rite-Lo-Speed Motors

Announcement is made of the licensing by the *Falk Corporation* of Milwaukee, of *J. D. Christian Engineers*, for the manufacture of Rite-Lo-Speed Motors under the original Christian design. *The Falk Corporation* is the new owner of U. S. patent No. 1,860,703, originally issued to J. D. Christian.

The standard motor units, known as Series HD, manufactured by the Christian organization, are produced under pending patent applications, exclusively owned by *J. D. Christian.*

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Low Heat Welding

Ferroweld is an electrode for welding cast iron, a product of the Lincoln Electric Company, of Cleveland, Ohio. The company has recently published a leaflet giving typical results of welding cast iron as reported by a few of the users. Write for a copy.

Hugo Effenberger and Associates, Inc., Racine, Wisconsin, has recently incorporated to manufacture Chamotte and other cement admixtures into finished products, etc. G. T. Flynn, A. La France and A. E. Flynn are the incorporators.

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Joseph S. Oechsle a consulting engineer of the Worthington Pump and Machinery Corporation, died at the Hahnemann Hospital in Philadelphia on December 24, 1933, at the age of 39.